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CONTROL®

22
COVER STORY

Supply chains get stronger with informed ordering, educational content, digitalized tools, collaboration and automation

by Jim Montague

ties
that
bind

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31
FLOW MEASUREMENT

Coriolis knows best

Coriolis flowmeters can be ideal for process improvement in challenging installations and conditions

by Greg McMillan

36
ASK THE EXPERTS

The effect of global warming on precipitation

A process control viewpoint of how global warming reduces precipitation in the sub-tropic regions

by Bela Liptak

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Departments

9 EDITOR'S PAGE
Can you spot a threat?
We need the right training to identify cyber-attacks

10 LESSONS LEARNED
The far-reaching power of EV batteries
How car battery optimization can cut home electricity costs in half

12 ON THE BUS
The lab is always right
Except when it isn't

13 WITHOUT WIRES
Fun with flow measurement
Insights to help you decide on the right technique for the job

14 INDUSTRY PERSPECTIVE
A half century of automation innovation
Productivity and downtime drive EZAutomation's offerings

16 IN PROCESS
Workforce shortages top CPG concerns
Crosby PRVs mark 150 years of pressure relief;
OT cybersecurity market to reach $21.6 billion by 2028;
Supplyframe starts carbon footprint program;
ABB to upgrade Smufit Kappa board machine

20 INDUSTRY PERSPECTIVE
Driving the boundless evolution of automation architecture
What's driving the inflection point across industry – and why now?

34 BOOK REVIEW
How to slay the giant
John Berra shows how to conquer today's complex business challenges

35 RESOURCES
Enterprise asset integration grab bag
Control's monthly resources guide

38 ROUNDUP
Gateways bridge to bring home data
Switches establish links to once-isolated devices, so they can put what they know in front of users

40 CONTROL TALK
Simulation and innovation for best process control
How first-principle simulations enable process control improvements

42 CONTROL REPORT
You do it
Be aware of the real prices of products and supply-chain infrastructures

AD INDEX

ABB Management Services 26
Azbil 26
Classic Automation 33
DigiKey 3
Emerson Electric............ 20-21, 26, 44
Endress+Hauser 4
EZAutomation 14-15
FieldComm Group............ 8
Fuji Electric Corp. of America 30
Hammond Mfg. 30
Inductive Automation .... Cover Tip
Krohne 18
Microcyber 26
Moore Industries............ 19,26
Pepperl+Fuchs 17,26
ProComSol 27,29
R. Stahl Schaltgerate GmbH............ 27
Softing 27
Trihedral Engineering 2
Yokogawa Electric 6,27

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2023

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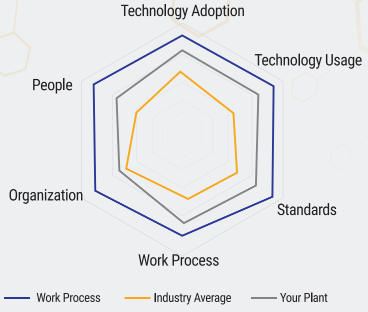

Analysis Chart Example

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Can you spot a threat?

We need the right training to identify cyber-attacks

LEN VERMILLION
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THANKFULLY, I wasn't traveling on July 18. My next flight was still a week away, but I'd been in similar situations, such as the one that transpired in airports worldwide following the Microsoft outage ironically caused by a CrowdStrike security software update. This event came on the heels of an AT&T network hacking incident (I'm a customer), but I dodged a bullet again. However, it was quite a week for cybersecurity watchers.

Unfortunately, we've all become numb to threats, disruptions and even successful cyber-attacks. What can we do? We need our networks, so we get angry and move on.

Industrial network operators don't have the luxury of shrugging their shoulders. Disruptions to OT networks don't just strand airline passengers; they can cause plane crashes, chemical releases, pipeline ruptures or other catastrophic incidents. There have been more than 17 million control system cyber-incidents that have occurred both maliciously and accidentally across all sectors globally, according to Joe Weiss, managing partner at Applied Control Solutions and author of the Unfettered Blog (controlglobal.com/indentifyingcyberattacks) at ControlGlobal.com. He adds that few of these incidents were identified as cyber-related. "If it's not happening on the network, the feeling seems to be, then it's not a hack. And if it's not a hack, it's not a cyber-incident," he writes.

"The question for process operators is whether they can recognize a cyber-attack in time to do something to stop it."

The question for industrial process operators is whether they can recognize a cyber-attack in time to do something to stop it. Cybersecurity experts continually point out that identifying control system incidents as cyber-related is a complicated endeavor, and the training to recognize control system incidents as being cyber-related is missing.

Cyber-threats aren't going anywhere. In fact, they only get worse. Critical infrastructure such as pipelines and refineries are prime targets, particularly as the processing industry further digitally transforms and increasingly embraces artificial intelligence (AI). Ironically, these two trends, while increasing risks, also offer solutions, but they aren't fool-proof.

Sometimes, it's still a good idea to rely on human ingenuity, but to do so, in this case, we must make sure we have the right training for our people to effectively fend off digitally caused disasters. ∞

Len Vermillion

The far-reaching power of EV batteries

How car battery optimization can cut household electricity costs in half

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"Bidirectional chargers operate as regular chargers most of the time but can reverse the direction of electricity flow to serve as backup storage for the grid."

ONE optimization strategy to provide backup storage for the power grid uses the electricity storage potential of the world's electric vehicles (EV) and infrastructure. Today, battery racks of most EVs are used only a couple hours a day. Whenever an EV is idle, its approximately 1,000-pound battery pack (Figure 1) and the 50-KWh electric power it stores do nothing.

There are about 3 million EVs on U.S. roads today, and by 2030 there will be 30 million. By the end of this decade, the combined storage capacity of the battery packs of all U.S. EVs, will exceed 1.5 GWh, which is more than the capacity of the world's largest battery storage system (bit.ly/SaurEnergy). In other words, these 30 million EVs will store as much power as a day's output from dozens of nuclear power plants.

Automotive and energy industry experts have long considered using EV batteries to provide storage for the grid. As the number of EVs on the road increases, the idea becomes more tangible because newer generations of electric vehicles already offer so-called bidirectional charge capability—meaning a free bidirectional charger comes with the car. The charger, when operating in the "supply from the grid" direction, automatically takes electricity from the grid to recharge the EV's batteries. When operating in the "supply to the grid" direction, it sends stored electricity in the battery-pack to the grid. Bidirectional chargers operate as regular chargers most of the time but can reverse the direction of electricity flow to serve as backup storage for the grid.

The current grid

As green energy sources contribute larger portions of our total energy supply, the amount of energy flowing through the grid must increase because of the increasing electricity demanded by EVs, heat pumps and artificial intelligence (AI) data centers. However, the direction of the flow must also reverse whenever green energy sources start or stop feeding electricity into the grid. In its present (one-directional) mode of operation, the grid can't reverse.

Today, most grids are served by traditional (fossil fuel and nuclear) power plants. These centralized systems supply electricity at different prices, depending on whether it's purchased during peak or off-peak periods. Peak-period prices are higher because meeting peak loads requires starting new and more expensive-to-operate generating units. In past configurations, users could minimize their total energy costs by minimizing the portion of the electricity they used during peak periods.

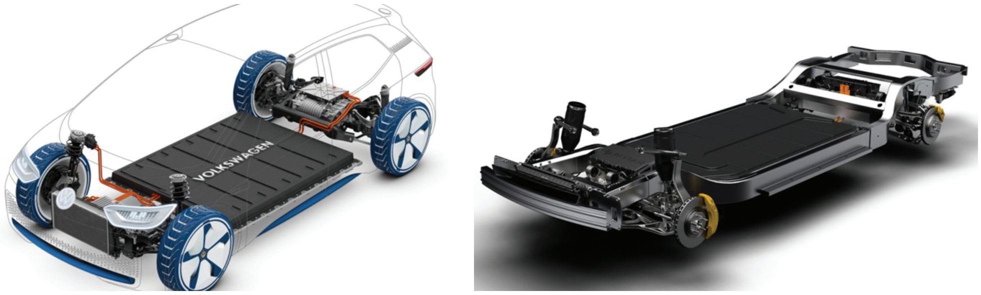

Figure 1: Battery packs always weigh more than the passengers (left) onboard an EV. For trucks or buses (right), they're even heavier.

The bidirectional grid

Today, in addition to transporting electricity from traditional power plants, the grid must also transport "green electricity" generated intermittently, which comes online or offline quickly. In Germany, when green power supplies came on, their electricity overloaded the grid because conventional power plants couldn't cut production fast enough, and users couldn't increase their demand fast enough, even if when the cost of electricity dropped to zero. The same problem occurs when the green electricity supply suddenly stops because conventional power plants can't increase production fast enough to compensate for the drop.

For the grid to simultaneously transport conventional and green electricity, the total electricity distribution system must include storage. And to use that storage, it must become bidirectional. Storage is provided in batteries, in hydrogen, by pumped hydraulic systems, etc.

Cutting costs in half

I recommend that all EV suppliers provide vehicles with bidirectional chargers free of charge, so their cars automatically recharge their batteries when electricity is inexpensive during off-peak periods, or automatically send their unneeded, stored electricity back to the grid during peak periods. By providing this bidirectional electricity transfer capability (buy low, sell high), EV manufacturers give car owners the ability to minimize their monthly electricity bills. This ability also reduces the operating cost of EVs, and provides the grid with backup electricity storage, which it needs when green electricity supplies stop or start up again.

The role of the process control profession in implementing this strategy is a critical one because it must design the intelligent and automatic operation of the bidirectional chargers and its displays, so that once the minimum storage limit is set, all the car owner must remember is connecting the charger.

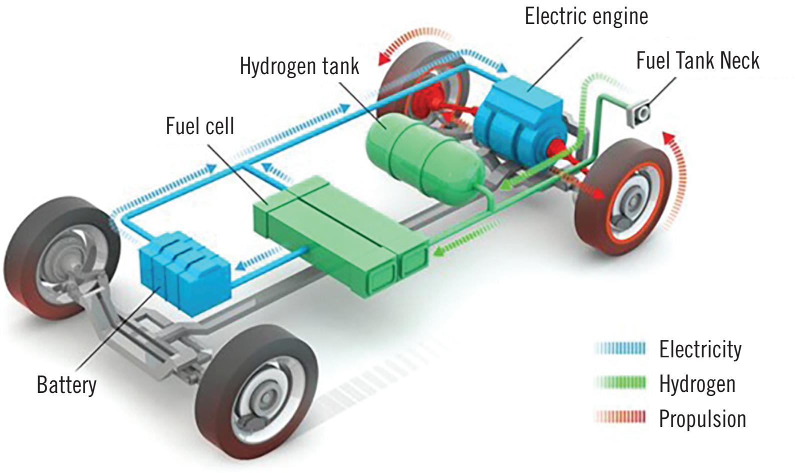

Figure 2: Fuel-cell electric vehicles (FCEV) are better suited for long-distance driving and use in trucks or buses. However, about 75,000 passenger cars are already on the roads, including Japan's 1,037-mile-long "hydrogen highway."

The future of EVs

In the long term, EVs will become our main means of transportation. However, their fuel won't be stored in batteries, but in light and green hydrogen tanks that generate electricity via fuel cells (Figure 2). This won't occur any time soon because new water electrolyzers must be invented to reduce the cost of green hydrogen to about $2/kg and because financial interests and the views of climate-change deniers also must be overcome.

Today, battery-fueled electric vehicle (BEV) suppliers have successfully delayed this trend by experimenting with car wash-style (drive-thru), battery-pack switching stations to cut refueling time to a few minutes. They've also increased the power density of their batteries, which is presently 0.15-0.25 kWh per kilogram of battery, while 1 kg of hydrogen provides 39.6 kWh.

While BEVs will be around for a decade or two, the safety consequences of increasing their power density and market forces resulting from their limited supply will make the eventual switch from batteries to fuel cells unavoidable. ∞

The lab is always right

Except when it isn't

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> **"False or aliased measurements can produce models that are useless."**

IT was a sweltering day, and Horace was despondent since his Reid vapor pressure (RVP) analyzer was at fault for an off-spec batch of premium fuel. In his refinery, the batch was "finaled" and released to the pipeline. "Giveaway" is when a batch exceeds specification, meaning the blender could have increased the percentage of a less-valued blending stock—especially butane.

Butane, sold as automotive fuel, is an upgrade for the component, worth millions of dollars in margins. It's valuable to blend fuel right up to the very precipice of becoming off-spec, so online octane and vapor pressure analyzers are used throughout a batch to maximize consumption of feedstocks such as butane.

Decades ago, online analyzers were invented as facsimiles of lab methods that analyzer results aimed to duplicate. ASTM International's RVP method was developed in the 1930s as a standard for internal combustion engine fuels. It calls for a pressure measurement with 4:1 vapor-to-liquid ratio in a 100 °F bath. Horace's machine drove its two pumps with cylinders sized to pump one part liquid and four parts vapor, and measure the (absolute) pressure in a 100 °F temperature bath.

Packing wear is inevitable and often causes disparities. Horace standardized against his water-displaced "proto" fuel (a golden batch thoroughly analyzed by the lab) to prevent any light ends from escaping into vapor space. Packing wear, bath temperature excursions and pressure transmitter drift can occur during a three- to six-hour batch—some refineries blend straight to pipeline—so a recent standardization wasn't beyond reproach.

Traditional analyzers have multiple variables that can affect the measurement result, and digital integration of online analytical equipment over various buses—primarily Modbus or Ethernet—is indispensable for measurement validation. Imagine if Horace knew his pumps were pumping precisely what they should have been, his temperature bath was on setpoint, and his pressure measurement was showing no evidence of drift. The highly mechanical, wear-prone device might have been more accurate and reliable than the lab.

I can't recall when photometric or optical absorption instruments, for example non-dispersive infrared (BDIR) optical instruments, were regular appliances in the lab. However, lab instruments achieved amazing capabilities by applying lasers, affordable computational power, and precise mechanics to provide high-resolution absorption spectra.

In the 1990s, a Fourier transform infrared (FTIR) of an interferometer signal could be resolved repeatably to produce a detailed spectrum in an online instrument. Sometimes, the raw spectra could be related to a component's concentration, but in many interesting cases—gasoline blending among them—properties such as RVP or octane were derived by chemometrics, which uses partial least squares regression, among other statistical tools, to calibrate the spectra with lab results.

Similar to process modeling, which applies similar regression mathematics to derive process models, it's often garbage in, garbage out. False or aliased measurements can produce models that are useless. As U.K. statistician George Box famously said, "All models are wrong, some are useful." But like validating process models, relationships derived from spectra can have reassuring correlations. Science has cataloged specific wavelengths, where compounds and characteristic molecular bonds absorb in the infrared and near-infrared.

Still, mathematically derived models, proven effective and useful in FTIR and Raman spectroscopy, rely on repeatable and consistent lab results. Perhaps some outliers fall out during statistical analysis. Ultimately, there's much reliance on lab standards, sampling and sample handling, and care and feeding of the lab instruments. ∞

Fun with flow measurement

Insights to help you decide on the right technique for the job

FLOW measurement represents as much as one-third of the sensor market, which is significant, not only for plant balance, but because it's how you get paid. Custody transfers require accurate measurements, while measurements used for control require repeatability. Most manufacturers strive to make their devices accurate and repeatable, but are mindful of whether accuracy is stated as percent of reading or percent of scale.

Fortunately, international standards and practices have recommendations for minimum upstream and downstream pipe lengths, and manufacturers also reinforce this in their user manuals to provide guidance on associated installation best practices. Many documents assume measurement of a "perfect single-phase fluid," which has no impurities, such as dirt, corrosion materials, or entrained gases or liquids. However, there's no perfect fluid because impurities are part of the real world and are found in any facility.

One critical factor in any flow measurement is gravity because heavier materials will be on the bottom, and we can use that information to make sure the sensor element is kept away from where gunk tends to accumulate.

Literature is available on how to improve the most historically, widely used orifice plate measurements, but other technologies also have their quirks. The following are some of the more interesting flow problems and solutions I encountered during my career, many because I worked in an extraction/mining environment containing solids and slurries. The solids ranged from rocks to micron-sized clay particles. Though there may not be rocks in your process, everyone has smaller particles from corrosion products to catalyst dust.

Vortex meters are more common, especially for liquid service. They operate off the von Karmon principle, which means the bluff body must be able to vibrate, so the embedded sensors can pick up the resulting frequency, and correlate that to the flow rate. Unfortunately, this vibration can be a particularly good compactor, pound small particles into the base receptacle as a solid, and cement them in the bluff body. The solution is keeping the solids away from the bottom of the bar by rotating it between 15° and 45°, which means rotating by one bolt hole from vertical to 45° if the meter is flanged and larger than 3.5 inches.

The critical components in a magnetic flowmeter are the electrodes, which tend to not like being hit with large objects or sandblasted with smaller particles. The solution is a deflector plate on the upstream face, which redirects the solids from the wall of the pipe to the center like a bug shield on a vehicle.

The most challenging measurement I worked on was a four-phase flow stream consisting of solids, oil/bitumen, water and air. Fortunately, the resulting measurement was for mass balance, so a close but repeatable measurement was needed. We used two different technologies for this measurement. One was non-intrusive and strapped to the outside of the pipe. The other was a Venturi meter with cast-insert throat liners, so we could pull the meter from service, and replace the liner without risk of losing pipe integrity.

These white, iron cast liners weren't as nice and smooth as a traditional Venturi, but they lasted several months between servicing intervals. We also used extended diaphragm differential pressure (DP) cells. However, rather than being flush, they were normally kept about ½-inch from flush, so the slurry wouldn't impinge on them directly. They also didn't have a large enough shelf on the nozzle for solids to accumulate on enough to bridge across the 3- or 4-inch nozzle and plug it.

Like any discipline, flow has its own lessons and experiences—often learned the hard way. Hopefully, sharing these experiences will provide food for thought about how similar problems can be solved. ∞

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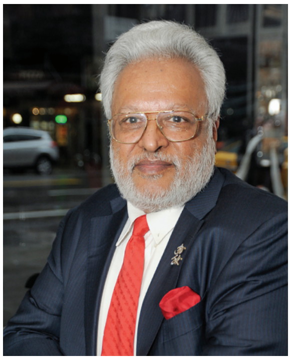
"Like any discipline, flow has its own lessons and experiences—often learned the hard way."

A half century of automation innovation



SHALABH KUMAR
Founder and Chairman,
AVG Automation

pdt.EZAutomation.net

NEXT year, AVG Automation, parent company of EZAutomation, a midwestern U.S. manufacturer and factory-direct purveyor of industrial automation systems and components, will celebrate 50 years since its founding in 1975. The automation technology landscape has changed dramatically since that time, but many of the underlying industry needs remain unchanged. To learn more about what's changed (and what hasn't), *Control* caught up with Shalabh "Shalli" Kumar, AVG founder and chairman, at the company's Carol Stream production facility in suburban Chicago.

Q: To get things started, perhaps you can share with us some perspective about the road you've traveled since starting AVG Automation now almost half a century ago?

A: AVG was founded in April 1975, and like you say, it has been quite a journey. I'm an electronics engineer, and new product development is my passion. The company was founded with the introduction of the programmable limit switch (PLS) that replaced rotary cam limit switches on a metal stamping press. Before this invention, it took two men two shifts to adjust and fine tune the timing of various functions such as feed and blow off in a press cycle for a particular die. Because of so much downtime to change over settings, the same part was often stamped for three or six months without a die changeover.

I thought of doing this electronically and the PLS was born, a whole new industry was created, and America changed the way metal stamping plants run. Now, die settings can be changed for a new part in less than 10 minutes. Applications for the PLS spread to the manufacture of metal cans, packaging plants, steel mills, control of water dams and even the gates of the White House.

EZAutomation was launched in 2005 in the midst of a sad and serious falling out with a former marketing partner. We had agreed to be the exclusive manufacturer of HMIs for them, but unfortunately, this partner copied our EZ-Touch series of HMIs to have them manufactured by another supplier in China. AVG sued, and in 2010, a Chicago jury found this former partner of ours guilty on 42 counts of breach of contract and misappropriating confidential intellectual property. Subsequently, both parties settled out of court. Today, the EZAutomation portfolio has grown to include more than 1,000 SKUs. Not only HMIs, but PLCs, I/O, LED message displays (marquees), power supplies, encoders, timers and proximity sensors.

Q: It's clear that, despite running such a large and successful organization, it's really the ability to create and bring to market innovative new solutions that both improve productivity and make life easier for our readers—and your customers—that satisfy your soul. Can you share with us some of the principles and priorities that guide your development efforts?

A: We were born in the Fisher Body metal stamping plants of General Motors, where two priorities were top of mind for the control engineers, maintenance engineers and technicians. Number one, to improve productivity. Number two, to reduce downtime. All my patents are geared toward addressing these issues, and in the process AVG developed five traits that are expressed in our products.

The first two include the highest processing power per cubic inch relative to other products on the market paired with the strongest immunity to electrical noise and conducted interference. That is what you would expect from a company born in automotive stamping plants. The third is the simplest human interface, and EZTouch is a legend in that respect.

Number four is the highest reliability products. Our Uticor and Autotech products deployed 40 to 50 years ago are still running and producing American goods. Number five is highest operating speed. How about solving 40,000 digital setpoints in less than 20 microseconds?

The EZTouch Series 7 HMI features online editing and a two-part assembly that allows the display and touchscreen to be easily replaced without disturbing the logic and communications electronics.

Q: You've often spoken and written about the marked decline of American manufacturing since the turn of the century, and especially its migration to China, which today accounts for some 30% of the world's products, including 60% of all electronic goods and 80% of automation products. But you've seen success producing automation products here in the U.S., and even some that outperform foreign competitors at a lower price. To what factors do you attribute this success?

A: First of all, there needs to be strong will and a commitment to make in America. Make no mistake, China is out there to become the sole superpower in the world by 2049, the 100th year anniversary of the current regime. They had a master plan to destroy American and European manufacturing industries, one by one with subsidized labor and factory overhead paid by the Chinese government from 1996 to 2008. They have waged an unrestricted war on American manufacturing, increasing our reliance on its exports, and stealing intellectual property and tens of millions of jobs.

Now, how AVG and EZAutomation can make and sell better products that are made in America as compared to those made in China at the same or lower price to the user is something of which we are extremely proud. I can't give out all our trade secrets, but I will tell you that DFM, or design for manufacturing, is where it starts. DFM, highly automated production lines and selling factory-direct makes this seemingly impossible task easy, just like our name.

Q: One of the latest EZAutomation products that I think exemplifies innovative features that go out of the way to make products easier and more flexible to work with over their lifecycle is the EZTouch 7 Series HMI. It has truly innovative features that help to head off process downtime, which, as you've already mentioned, is a huge issues for process manufactures that sometimes don't shut down for months or years at a time. With the Series 7 HMI, you can make configuration changes on the fly—or even swap out the display with minimal disruption to the process. Usually, you'd need a full-blown distributed control to do that. Can you tell us how you make that work in a touchscreen form factor?

A: Again, one of our core competencies is to reduce downtime in our customers' plants. Because of that, we took another giant leap in the form of the EZTouch Series 7 HMI. The weakest components in an HMI are the touchscreen and the display. Operations may require the frequent pressing of a particular button on the screen, limiting the life of any HMI. Unlike the CPU and communication electronics, the touchscreen and the display are subject to the plant environment, such as oil fumes, dust, chemicals and the like. So, what did we do? We split the HMI into two parts, with the touchscreen and display housed in a front panel of the HMI and the CPU and the rest of the electronics in a back panel.

The two halves are connected through an HDMI cable running through a ¾-in. hole in the door of the cabinet. There's no longer a need to cut a big hole in the door. If the touchscreen needs to be replaced, it takes less than two minutes to disconnect the two and put in a new front panel. No need to program and set up the new HMI. No programming software or programming cable are needed. Further, the HDMI cable can now be 4-ft. long, allowing the backend electronics to be mounted away from the front-facing door of the control panel in a more convenient place in the cabinet.

The EZTouch Series 7 also shares the patented ability to edit displays, while online with the company's other HMI and PLC products. Display graphics can be edited and updated without interrupting machine operation—even from a Wi-Fi-enabled PC up to 50 ft. away. We have dual memory system in all our HMIs. One is active, and the other, a back-up system, can be edited without shutdown, compared with the half-hour interruption required by competitive offerings. This is especially important for owners of new machines because studies have shown that the typical HMI user wants 10 display changes in the first three months of operation. And that means lots of money and lots of interruptions—if you don't have EZTouch, that is. ∞

Workforce shortage among top CPG concerns

Survey of consumer packaged goods leaders gauges efforts to improve planning and increase training

WORKFORCE shortages, inflation impacts and energy costs are the top external obstacles identified by consumer packaged goods (CPG) manufacturers in 2024, according to the 9th annual "State of smart manufacturing report: CPG edition" by Rockwell Automation (www.rockwellautomation.com/en-us/capabilities/digital-transformation/state-of-smart-manufacturing.html). Results of the global survey released on July 10 consist of responses from 158 CPG leaders of home, personal care, food and beverage companies in 17 countries.

The respondents report they're using emerging technologies to maximize workforce potential, improve planning and minimize risk. These technologies include smart manufacturing and automation, which can enhance and augment the value of employees, and help their companies to attract, engage and retain personnel.

The respondents also acknowledge that neglecting to adapt to the CPG industry's transformation can stifle growth and competitiveness, especially because the overall manufacturing sector could experience as many as 2.1 million unfilled jobs by 2030 if present workforce needs aren't addressed.

The study also found that:

- 86% of CPG manufacturers are using or evaluating smart manufacturing technologies in 2024.
- Technology investments increased by 26 percentage points year-over-year from 21% to 27% of the companies' operating budgets.
- Blockchain technology is one of the top 10 investment areas for CPG manufacturers in 2024, and ranked second overall.
- Training existing employees about how to use new processes is the top workforce-related challenge for CPG manufacturers this year.
- The quality of the products they produce matters the most to environmental, social and governance (ESG) programs of CPG manufacturers.

"As CPG manufacturing leaders navigate a complex and evolving landscape, they're realizing that supporting their workforces will be a critical factor for success," explains Steve Deitzer, global industry VP for CPG at Rockwell Automation. "This year's report underscores the need for CPG manufacturers to prioritize their workforce development efforts because ensuring employees are well-trained and equipped to leverage emerging technologies will be essential for overcoming industry challenges and achieving sustainable growth."

The survey's full results are available at www.rockwellautomation.com/en-us/capabilities/digital-transformation/state-of-smart-manufacturing.html

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Crosby PRVs mark 150 years of pressure relief

Marking a milestone in the history of pressure relief valves (PRV) and overpressure protection, Emerson celebrated July 17 the 150th anniversary of its Crosby PRVs (www.emerson.com/en-us/automation/brands/crosby). Crosby devices are field-proven and engineered to meet the latest regulatory standards.

For example, Crosby Balanced Diaphragm technology debuted in 2022, and eliminates bellows in PRVs, ensuring reliable, balanced operation against backpressure. This innovation reduces maintenance costs, improves performance, and enhances safety with a robust design. Also in 2022, Crosby valves gained Bellows Leak Detection that provides instant notification of ruptures. This enables prompt maintenance, reduces fugitive emissions, and provides event logging for intelligent, root-cause failure analyses.

Crosby's overpressure protection products include:

- J-Series that's used in various applications, including air, gas, steam, vapor, liquid and two-phase media.
- Omni-Trim that also provides thermal relief in air, gas, vapor, liquid, and steam applications.
- H-Series PRV that's used in power industry, steam-safety applications, such as economizers, steam drums, superheaters and reheaters. Its limits were extended this year to more than 7,250 psi/500 bar and 1,200 °F/648 °C.

OT cybersecurity market to reach $21.6 billion by 2028

The operations technology (OT) cybersecurity market is expected to grow at a 9.2% compound annual growth rate (CAGR) from $12.75 billion in 2023 to about $21.6 billion by 2028, according to the “Operational technology security markets” study released on June 24 by ABI Research (www.abiresearch.com).

ABI reports waves of digitization and smart manufacturing are making cyber-attacks on OT widespread and frequent. Its research indicates that network security and segmentation technologies will grow the most, followed by identity and access management and endpoint protection.

“Every industrial sector is embracing some digitization and concept of Industry 4.0," says Michael Amiri, senior industrial cybersecurity analyst at ABI. "As a result, the potential for cyber-threats has increased, prompting demand for robust defensive measures.”

ABI speculates OT and Internet of Things (IoT) spending could surpass information technology (IT) spending in the future because the number of laptops, tablet PCs and other IT-related devices has hit a plateau. “The fact is that OT and IoT devices are just beginning to expand and are far more numerous,” explains Amiri. “An industrial plant could have tens of thousands of sensors, routers and PLCs, all of which must be protected from malicious actors.”

Amiri reports that demand has grown for technologies that secure OT networks because they’re enhanced with artificial intelligence (AI) and behavioral traffic analysis to detect and respond to OT-specific network threats. However, ABI expects segmentation technologies that secure OT traffic will still generate the most revenue in the OT cybersecurity market. This is because they not only provide cost-effective partitioning, but also allow customization of security controls and data flows for each isolated segment.

“Recent macroeconomic pressures don’t seem to impact the OT cybersecurity market,” adds Amiri. “On the contrary, rapid digitization and escalating geopolitical tensions have contributed to increased spending and market revenues, especially in sectors most prone to cyberattacks.”

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Supplyframe starts carbon footprint program

Supplyframe (supplyframe.com) launched July 17 its Electronics Product Carbon Footprint (PCF) program that allows manufacturers to access carbon footprint data for more than 300 million electronic parts. It's intended to let companies measure and report the sustainability of new product designs and sourcing decisions, and enable compliance reporting. Previously, companies trying to calculate a roll-up value would have had to dedicate weeks or months to get this data at the part or component level of a complex bill of materials (BoM).

"Until now, engineers designing new products and procurement teams tasked with obtaining components for those products had no way to evaluate the CO_2 emissions of a new design or purchasing decision," says Steve Flagg, CEO and founder at Supplyframe. "PCF gives them specific product carbon footprint details to meet regulatory reporting requirements and ultimately identify better alternatives that balance corporate efficiency, cost optimization and sustainability goals."

ABB to upgrade Smurfit Kappa board machine

ABB Process Automation (go.abb/processautomation) reported July 9 that it will modernize Smurfit Kappa's (www.smurfitkappa.com) Paper Machine 5 (PM5) at its Cerro Gordo corrugated cardboard mill near Mexico City. In their first collaboration, Smurfit Kappa will add ABB's Ability System 800xA distributed control system (DCS), accompanied by a paper-machine drives system with advanced drives and motors designed to optimize PM5's performance, and increase its production efficiency and output.

The PM5 machine required speed and tension controls to optimally, while minimizing downtime. ABB drive technology, complemented by the DCS, will help secure optimum speed and torque control of the paper machine's sectional drives for years. This is achieved by integrating a direct torque control algorithm, which ensures precise control, and enables consistent quality and minimizes waste over long periods. ∞

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SIGNALS AND INDICATORS

- Following successful laboratory trials, **Integrals Power** (integralspower.co.uk) reported July 22 that it's started producing proprietary, cathode-active lithium iron phosphate (LFP) and lithium manganese iron phosphate (LMFP) at its new pilot plant in Milton Keynes, U.K. Developed in-house, Integrals' modular production facility for LFP and LMFP can be readily scaled to higher volumes to meet demand, and produce a range of chemistries.
- After partnering for decades, **Siemens Digital Industries** (www.siemens.com) and **BAE Systems** (www.baesystems.com) announced July 22 they're collaborating regioon engineering and manufacturing technologies embracing digital transformation, while using digital capabilities in program lifecycles.
- **Mouser Electronics Inc.** (resources.mouser.com/wireless-networking) opened a content hub on July 25 that provides the latest resources for wireless networking and standards. This hub features articles, blog posts, ebooks and products, which give engineers the know-how to design wireless networks with assistance from Mouser's technical team.
- **GridBeyond** (www.gridbeyond.com), an energy management company, announced July 23 that it's partnering with energy curtailment software supplier **OBM Inc.** (https://obm.io). They're seeking to transform energy management for operations of all sizes by providing mutual customers with GridBeyond's AI-powered energy management solutions and OBM's Foreman large, flexible-load, facility-management software.
- **ABB** (go.abb/processautomation) launched July 2 its Do More with Digital program, a global campaign highlighting opportunities for the process industries to realize their full potential with digital transformation. By using its ties in the pulp and paper, mining, metals and cement industries, ABB plans to equip these sectors with advanced, industry-specific solutions to allow them to accelerate adoption sooner.
- **The Fraba Group** (www.fraba.com), a supplier of sensors for industrial motion control and safety systems, reported July 16 that it's opening a new business unit in China. The new company, Fraba Industrial Automation (Shanghai) Co. Ltd.), will serve the expanding Chinese industrial automation market. The company was established in March 2024 as a wholly foreign-owned enterprise (WFOE).

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Driving the boundless evolution of automation architecture

PETER ZORNIO
Chief Technology Officer,
Emerson

WE'VE heard a lot about the evolution of automation architecture, particularly as companies embark on digital transformation plans. But what are the drivers of this march toward what Emerson terms "boundless automation"? To find out, *Control* talked with Peter Zornio, Chief Technology Officer at Emerson.

Q: What is driving this inflection point—the evolution of automation architecture—in the industry and why now?

A: First, the automation architecture we work with today has been fundamentally the same since the mid-1990s. The last big technology switch was moving to open systems such as Windows, PCs, Ethernet networks, and utilizing what was, at the time, state-of-the-art IT technology for automation. Since then, there's been advances in IT computing with the cloud playing a large role. So, it's time for the automation world to think about how we're going to take advantage of these technologies that the IT world pioneered because, historically, we adopt those after they're proven. As customers implement digital transformation, they run into limitations because of current systems and the very siloed data repositories and architecture they had until now. Plus, the big push around analytics, artificial intelligence (AI), and new technology we can use to analyze data to drive better results and optimization, means there's also a new drive for integrated data that's contextualized in a way that AI and analytics can work with it.

Q: Is boundless automation only for new construction or can it be adopted for existing operations?

A: For greenfield facilities, it's a no brainer. We have a customer who was building a new facility and said, "Transforming sounds hard. I want to get it right on day one. I want to be born digital." "Born Digital," as a term, stuck, and we've been using it ever since. Plants that are born digital have many of the core elements of the boundless automation vision.

"Born Digital" new construction means putting all the infrastructure in place from the beginning, including a comprehensive data infrastructure. It also means building a plant with a digital twin from the beginning, and using the digital twin to train operators as well as figure out new ways that you can change operations. It includes designing for reliability-centered maintenance, adding wireless instrumentation for equipment condition data, and being able to diagnose equipment's health using both first principles and AI-based models. It's starting up with state-based control and APC from the beginning. It means a data management strategy that's secure but more open, making data accessible from anywhere, by anyone who needs it. All these things we talk about in digital transformation need this infrastructure.

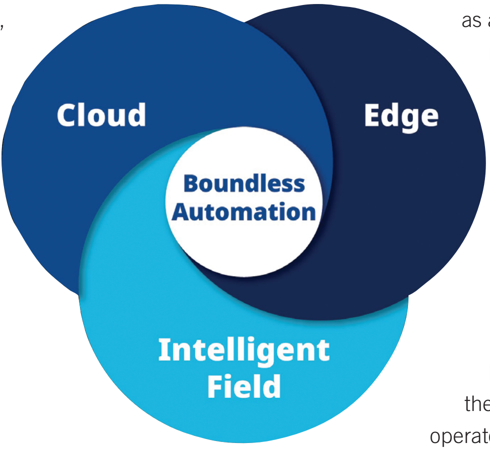
For existing facilities, for the last six or seven years, we've been trying to put in many of these elements, such as a comprehensive data infrastructure, into those facilities. It can be done one piece at a time, but every piece must be cost-justified and have a return on investment (ROI).

Q: What are the technical differences with this kind of architecture?

A: Some of the technical differences and technologies include new field connectivity technology such as Advanced Physical Layer (APL), which is going to provide a bigger data pipeline for the field. The fact that it can run already well-established standardized Ethernet protocols should make integration easier between field devices.

We're also pioneering a new family of wireless devices. We see the low-power sensor bands that are built into cellular as a great new opportunity for more internet of things (IoT) wireless devices. Narrowband IoT (NB-IoT) and LTE-M are special radio bands that are rolled out across most cellular infrastructures in most countries, and are specifically designed for low-bandwidth, long-range sensor data. You can build a sensor that will run a long time on a battery like we do with WirelessHART in a plant, but use the existing cellular infrastructure. We see a generation of mobile sensors coming out of that, not just for inside the plant, but anywhere. For instance, a product we're coming out with soon goes on chemical tote tanks, a radar level sensor that goes on the top and tells you where that tank is anywhere in the world and what's the level measurement.

As we move to more modern Linux-based edge technology, we believe we can make that software execution environment, running on off-the-shelf hardware, reliable and low-latency enough to run control. The last piece of proprietary, purpose-built hardware in the automation system is the controller, and we can see it eventually being replaced, just like the rest of the automation architecture, with off-the-shelf hardware and off-the-shelf operating systems, all moving to the edge. Then the automation system is truly, purely "software defined"—an integrated suite of software that runs on open technology.



Q: What is unified data and how can it be achieved?
A: As people embarked on digital transformation programs, they found the hard part is figuring out how to get the data together in a consistent context where they could apply the analytics or AI. A core part of boundless automation, at least for the suite of Emerson and AspenTech software applications, is a common, consistent data infrastructure and data model. This unified data infrastructure spans what we think of today as level two, level three and level four, all together into a unified data "fabric."

We also see a new way to do cybersecurity. In the IT world, they talk a lot about what's called zero-trust security, especially for authentication. Today, for OT, we rely on layers of networks, the Purdue model and what we call layers of defense with firewalls in between. That's not going to work well when we need to have a hyper-connected and hyper-data-sharing architecture. For OT, we envision zero-trust evolving to where you don't depend on where you are in a network or segmentation of networks. It's more about the applications and users having to authenticate and authorize themselves with each other application regardless of where they're executing.

Q: What is the relationship of AI to boundless automation?
A: I often like to say, in the automation world, we were AI before AI was cool. We've been using AI since the mid-1980s with multivariable predictive control. DeltaV came out in the mid-1990s with neural networks as a standard function. Machine learning has been diagnosing equipment health since the mid-1990s. Most of AspenTech's products have embedded AI, whether deep learning, neural networks or machine learning.

The new generation of technology, large multipurpose general models that are multimodal like GPT, contain good, large-language models that open the possibility of new applications like operator advisory, very advanced product support chatbots, and auto configuration of systems with language as the interface. And for operations, all of this AI needs an infrastructure that makes data easily available in a consistent contextualized manner. So that's where, again, it comes back to the unified data fabric being an important part of the strategy.

Ultimately, the boundless automation vision is about making data more accessible and easier to convert into actionable insights by pushing computing power closest to where it can add value. AI is one very exciting use case for that vision, but there are countless other ways that a boundless automation strategy will help organizations operate more effectively. ∞

ties that bind

by Jim Montague

Suppliers and distributors use analytical ordering, online education, digitalization and collaboration to rope in supply chain challenges

EVERYONE'S always on the lookout for the weakest link, but what about all the other hardworking connections that keep their chains, fabrics, infrastructures and societies up and running? Invisible and taken for granted, as usual, just like every piece of support equipment and the professionals who optimize and maintain them. Only immediate crises or laughably overdue problems get attention.

The same goes for supply chains, of course, even though they come in different combinations of technical types and geographical locations. It seems like no one proactively greases wheels that don't squeak. Unfortunately, this chronic and apparently eternal neglect is magnified when delays and other temporary difficulties arise.

Seeking normalcy

Consequently, even though process control and automation suppliers report their supply lines and businesses have mostly returned to pre-pandemic normalcy, they're still facing persistent microprocessor scarcity and delays, dilemmas over reshoring sources of raw materials and basic parts, and diversifying and drawing their supply chains closer together—so they'll hopefully be more effective in weathering future crises.

"We're almost back to normal, but we still have issues on the power equipment side. For three years during COVID-19, automation businesses had to deal with chip shortages, which were made worse because many

Photo: Derek Chamberlain / Shutterstock AI

suppliers didn't diversify their chip sources earlier. The longest lead times were for analog cards that go into PLCs and drives, especially because many chips were going to higher-priority medical, telecommunications and automotive suppliers first," says Colleen Goldsborough, executive board member at the International Society of Automation (www.isa.org) and an industry sales manager at United Electric Supply (www.unitedelectric.com), a Schneider Electric distributor. "Now, our suppliers are mostly caught up, and we're under the impression that they're diversifying their component source and ramping up domestic production, and we're seeing it happen."

Jeff Payne, business development team captain at AutomationDirect (www.automationdirect.com), adds, "For the most part, we're back to business as usual and on a good growth trend. The majority of our suppliers came out the other side, and are no longer having trouble meeting the demands we're seeing. However, demand has also slowed. We're still trying to filter the data about who was out of stock or had tons of it, but it's hard to say it was organic. I'm sure many different influences played a role, but one contributing factor was the overabundance of inventory padding we saw in 2021-22. Initially, when the supply chain began slowing and the component shortage hit consumers, we saw people begin to pad their personal inventories. You can't blame them. They had orders to fill, and parts were in short supply."

Subdue the overstock swing

While the health of many supply chains has improved, memories of chronic shortages and prohibitive lead times are fresh enough that many suppliers and clients are retaining practices they adopted during and after the pandemic. Ironically, this includes dealing with more recent over-ordering and oversupplies of some products and the costs associated with excess inventories.

Goldsborough reports that Schneider Electric's distribution center is well-stocked enough that any products United Electric requires are only about a week away, which is a big improvement over delays during the pandemic. "Lead times over the previous three years were three to nine months, so we and our customers had to seek other sources and methods," explains Goldsborough. "Projects had to be forecasted further ahead, so orders could get into pipelines sooner. Customers like system integrators had to wait for products, so they had to postpone projects or not do them at all. Each project had to be considered on a case-by-case basis, and we all had to get creative. If it was going to take a year to get an eight-slot PLC backplane, we try to see if it could be done with a four-slot PLC backplane."

Strains on the chain

Just as process safety experts evaluate the severity and frequency of potential incidents, suppliers, system integrators and end-users can investigate the upstream and downstream links in their supply chains, identify definite and potential hurdles, gauge likely impacts, and develop responses. The primary supply chain variables are:

- **Distance** — More miles logically means more obstacles. Ground, maritime and air modalities each present different issues, such as events like the recent Crowdstrike computer glitch that halted and delayed many U.S. flights.

- **Natural causes** — Beyond the obvious oceans and mountain ranges, where container ships can get stuck or sink, and trucks can lose their brakes or crash, increasing hurricanes, storm surges, flooding and wildfires attributed to global warming are damaging vulnerable communities and supply-chain participants. Even ash from volcanos can disrupt flights and supply lines, which occurred in Iceland and Europe several years ago.

- **Human conflicts** — The ongoing invasions in Ukraine and Gaza are just the latest in an endless series of regional wars and repressions that not only destroy people, homes and local economies, but can sever supply chains and indirectly hinder manufacturers and customers worldwide.

- **Costs** — Shipping expenses are just the beginning. Scarce raw materials and long lead times for microprocessors and other parts can make products and projects prohibitively costly. These must be weighed against the expense of reshoring and producing products locally, which can mean higher labor costs.

- **Technology profiles** — Because basic hardware and parts can often be made by multiple companies in many places, it's easier to diversify suppliers for them, they're typically easier to reshore, and their lead times can be shortened quickly. However, more complex, specialized and proprietary products are harder to produce, and often involve added partners and supply chain links, which keeps their lead times longer and persistently difficult to reduce.

- **Over-ordering and overstocking** — previous scarcity drove users and suppliers to order more materials and parts earlier, but this often left them with excessive and costly inventories once the shortages waned.

Uma Pingali, global president of sales at Farnell, which includes regional brands Newark (www.newark.com) and element14, reports, "In hindsight, having a big customer base and buying in volume are the best ways to avoid overstocking after shortages. However, in the present dynamic market, it helps to use demand-planning software because ever-changing economic conditions can again cause supply-chain shifts. The algorithms in these demand-planning tools will support modifying purchase volumes to ballast market changes swiftly. With sufficient supply-chain data, demand-planning software can quickly indicate the appropriate inventories to address even rapidly changing conditions."

Pingali adds that suppliers and distributors used to enjoy longtime customers, who could be counted on for consistent requirements and steady ordering. However, digitalization, rapid shifts in solution design trends involving hardware enabled by software, compounded by COVID-19, upended previously stable supply chains, and beset Farnell and its divisions with many new and unfamiliar customers with unusual requirements and practices, and often smaller-volume orders.

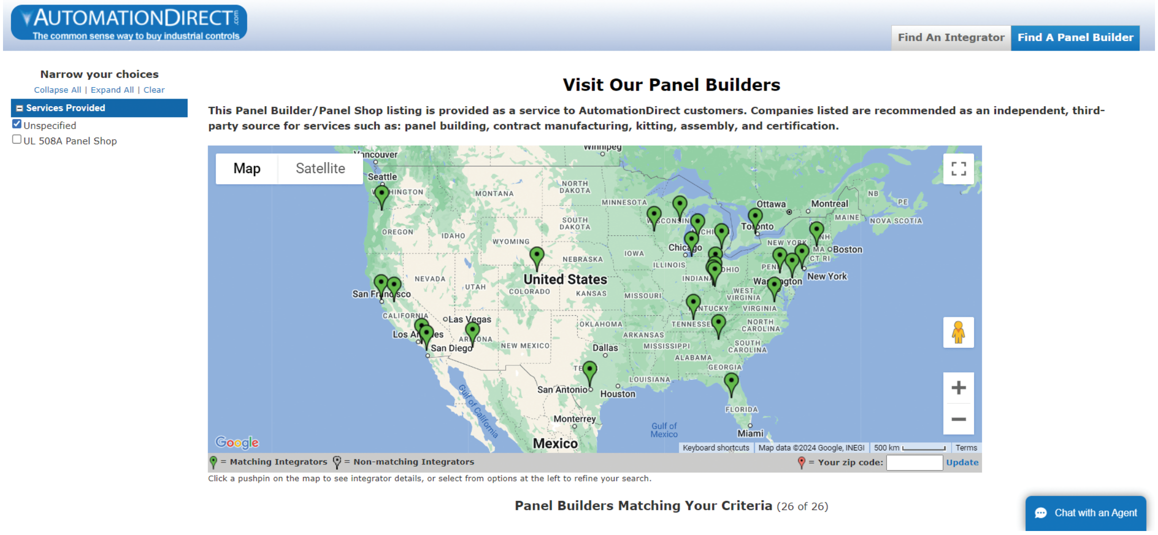
"Supplier lead times for most products are presently at eight to 12 weeks, which is much better than the nine months we experienced during the pandemic. Overall conditions have improved, of course, but better demand-and-fulfillment planning deserves a lot of credit, too," explains Pingali. "It lets us see demand trends further into the future."

Hungry for chips!

Even though some monitoring and control tasks can move from hardware to software and cloud-computing, most of these jobs are still performed by modules on plant-floors or in the field—and none of those servers, software and components can operate without microprocessors. Even the most sophisticated software has to run somewhere.

This reality makes microprocessors indispensable no matter how long their lead times are. It was also the primary inspiration for the Biden Administration's Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act, which passed in August 2022, and calls for a more than $230 billion investment in U.S. microprocessor manufacturing and related research.

"Many manufacturers worldwide shut down or vastly cut production during COVID-19 in 2020-21, so we saw lead times for microprocessors and other electrical components increase from eight weeks to 55-75 weeks," says Scott Saunders, president and CEO at Moore Industries-International Inc. (www.miinet.com). "We also couldn't get critical components because the largest distributors prioritized in favor of their biggest customers, namely telecommunications and automotive. Most industrial customers use lower volumes of integrated circuits and microprocessors, so we were pushed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Click a pushpin on the map to see integrator details, or select from options at the left to refine your search.

Panel Builders Matching Your Criteria (26 of 26)

Figure 1: AutomationDirect's Panel Builder program (www.automationdirect.com/adc/form/admin/si?mode=panel) lists independent, third-party shops that provide panel building, contract manufacturing, kitting, assembly, certification and other services, which can help clients with their reshoring and source diversification efforts for different product categories. It joins AutomationDirect's 10-year-old System Integrator Direct program. Source: AutomationDirect

to the back of the line. Being on the second tier is a huge problem, but ending up in the third or fourth tier is a nightmare.”

Even though lead times eventually improved a bit for these key components as the pandemic dissipated, Saunders reports that a new lead-time problem surfaced that many people didn’t predict. The pandemic exerted financial pressure on component manufacturers worldwide, and many were forced to sell to competing suppliers through a merger and acquisition (M&A) process, or they had to close permanently. Saunders adds the M&A resulted in key components becoming obsolete, and led to unforeseen, last-time buy options for suppliers like Moore. This short notice obsolescence added further lead-time challenges, higher prices and critical line-down scenarios.

“When a chip supplier goes out of business or merges with a larger company that stops making a chip we’ve designed into several products, all the software and firmware we’ve written has to be ported over to a replacement chip,” explains Saunders. “This can be very costly, consumes development time, and has to be completed as quickly as possible to prevent line-down situations. On the flip side, if you agree to a last-time buy of these parts—which is often your only choice—prices can easily go from $2.50 to $14.50 each, which drastically increases inventory levels and manufacturing costs.

“No supplier can escape this problem. We’re rewriting software and firmware for existing products when we’d rather write new software for new products. Our headaches quadruple when a chipmaker or key component supplier goes out of business. While lead times are slowly getting better on some parts, there's still component obsolescence as a direct result of the pandemic.”

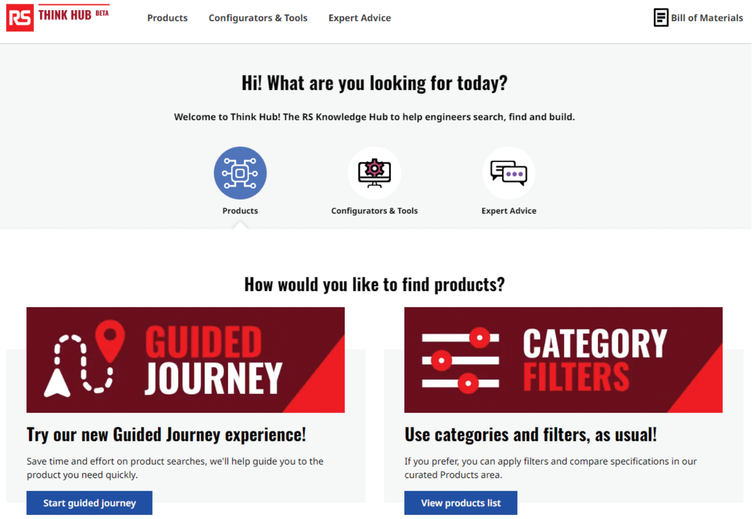

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Figure 2: RS Think Hub (rs-thinkhub.com) is a digital platform that helps engineers and other technical professionals find and buy the most appropriate products for their applications and faciltiies. Launched in the U.K. in 2022, it will be available in the Americas and Europe in 3Q24. Think Hub’s two main parts include a comparison tool with smart search and filtering to zero-in on the best products, and let users compare specs for different products from multiple companies, instead of focusing on supplier-specific brands. Its second section provides product pages and documentation, such as CAD files and datasheets. Source: RS Group

Invasion of the videos

Beyond getting everyone to interact on Microsoft Teams and other video-streaming services, another helpful habit that outlasted COVID-19 is using videos, podcasts and other online content for research, education and training—and resolving supply-chain issues. In fact, visitors accessing AutomationDirect’s video libraries spiked during the pandemic, and it had about 13 million views across all topics during the past 12 months.

“People have grown accustomed to finding do-it-yourself videos for almost every task, and this translate nicely for our industries,” adds Payne. “Our content creation is targeted at users, who may not have the experience or training that a large corporate engineering team has. We create hundreds of user manuals and videos every year that are tailored to customers, who may need help getting started or are seeking details about PID loop fundamentals. Our documentation and videos walk visitors through learning, understanding, set up, and the variables that impact a process."

More recently, AutomationDirect launched its Panel Builder program (www.automationdirect.com/adc/form/admin/si?mode=panel) that went live on its website in March 2023. Its lists independent, third-party shops and other suppliers that provide panel building, contract manufacturing, kitting, assembly, certification and other services, which can help clients with their re-shoring and source diversification efforts for different product categories. It joins AutomationDirect’s 10-year-old System Integrator (SI) Direct program (Figure 1).

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ABB's Swirl and Vortex flowmeters are available for the first time with Ethernet-APL connectivity, allowing for high-speed transmission of field data. Built to adhere to the most stringent safety requirements, the innovative flowmeters open new possibilities for the chemical, hydrogen and oil & gas industries.

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azbil
Smart ESD Device for SIS

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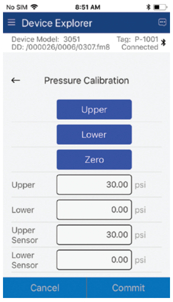

Device Model: 3051
DD: /000026/0006/0307.fm8
Tag: P-1001
Connected

Upper 30.00 psi
Lower 0.00 psi
Upper Sensor 30.00 psi
Lower Sensor 0.00 psi

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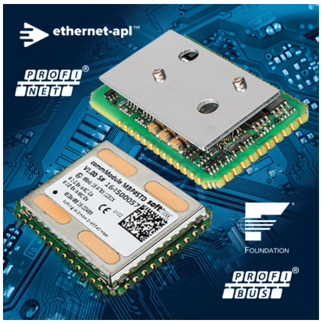

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Steps to take, links to add

Just like any process control application, supply chains can be measured, evaluated and optimized by adopting some essential best practices. Here are some of the most useful:

- Identify the supply chains your organization is part of, investigate their upstream and downstream links, detail what moves over them, document their technical characteristics, and describe distances and likely obstacles.
- Formulate project designs sooner in the overall development process, but strive to avoid overcommitting to inflexible plans that can't be revised.
- Establish and preserve continuous communications between all internal and external supply chain participants.
- Update colleagues and customers on order statuses, delays and other issues to avoid misunderstandings.
- Cultivate closer ties with suppliers, distributors and other partners, who may be willing to store a manufacturer, OEM or end-user's frequently used products in their inventory until the customer is ready to deploy them.
- Employ common, uniform parts and products, so there will be less dedicated, unique items that can't be used elsewhere. This includes deploying more modular software, systems and components that are easier to adjust and switch out. Comparison tools include Octopart (www.octopart.com), SAP Ariba (service.ariba.com), SourceForge (www.sourceforge.net) and Supplyframe (www.supplyframe.com).
- Support reshoring and other supply-chain shortening efforts by patronizing suppliers, whose products may be more costly in the short-term, but will likely pay back the difference in the form of fewer delays and obstacles in the future.
- Research artificial intelligence (AI) tools that can streamline supply chain and project planning efforts. These include Hybrique (www.hybrique.com) and Jaggaer (www.jaggaer.com).

Continuing education, opening dialogs

Because awareness and know-how breathe life into supply chains and other structures, education, interaction and collaboration are crucial at all stages and along all avenues.

"We've been part of the supply chains of our oil and gas, refining, chemical and energy customers for more than 50 years, but many habits changed during COVID-19," says Sara Anderberg, product manager of non-contacting radar (NCR) technology at Emerson (www.emerson.com/en-us/automation/measurement-instrumentation/level). "People are doing more online research before making decisions, and we're all attending more online meetings. Because it was necessary during the pandemic, it became more acceptable to connect using digital tools like Microsoft Teams. One of the benefits of video streaming is we can demonstrate products, and explore devices and software without visiting in-person."

To better cope with longer product lead times and project delays during COVID-19, Anderberg reports that her colleagues sought to balance shortages by opening dialogs and working more closely with their clients to see if projects could be redesigned or if different products could be used. Nowadays, these interactions are also enabled by Emerson's web-based Level Technology Advisor and Connect with an Expert program, which lets users ask questions of experts, collaborate on troubleshooting, find documents, get support for pinpointing the most suitable technology and devices for a specific technology, access quick-start guides, or set up meetings.

Anderberg adds establishing and maintaining these relationships was especially helpful when Emerson launched several NCR transmitters during and after the pandemic. "When we released the Rosemount 1408, Rosemount 3408 and Rosemount 1208 level transmitters, they could be configured and purchased online," explains Anderberg. "This capability has been expanded to all our level products, so customers can find them, view interactive videos and 3D demonstrations, and configure and buy them. Online ordering has been available for a long time, but now we have a better-defined user experience."

Discovering the best fit

Despite COVID-19's overall impact, RS Group (www.rsgroup.com) reports its 25 worldwide distribution sites were still able to obtain products relatively quickly. For example, RS opened an operations facility in Bad Hersfeld, Germany, that was doubled in size before the pandemic started. It accommodates customers, who used to conduct 61% of transactions digitally, but grew to do more online ordering they because got comfortable with it during the pandemic.

"COVID-19 accelerated customers finding and buying products online, and engineers discovering more automation and control products," says Rashdeep Kelf, head of supplier partnerships at RS Think Hub Europe, Middle East and Africa (EMEA). "However, they also needed guidance because many suppliers' websites have conflicting information, which makes it time-consuming for customers to find the right solutions. This is why we developed RS Think Hub's discovery element."

RS Think Hub (rs-thinkhub.com) is a digital, online platform that helps users find and buy the most appropriate products. Launched in the U.K, in 2022, it will be available in the Americas and Europe in 3Q24. RS Think Hub features a comparison tool with smart search and filtering to zero-in on the best products, and let users compare specs for products from multiple companies, instead of focusing on supplier-specific brands. Its second section provides product pages and documentation, such as CAD files and datasheets (Figure 2).

"RS Think Hub provides one place for accurate information, technical assets, manuals, certificates, CAD files and supporting materials. This one-stop-shop makes discovery and comparison more efficient," adds Kelf. "Think Hub also lets users access digital tools, learn about new bill of materials (BoM), and host FAQs with supplier experts. We're even looking at using generative AI to help our technical teams deliver onsite customer support."

Getting (digitally) nimble

To offset unavailable parts, ISA and United Electric's Goldsborough adds that suppliers, system integrators and customers learned to lean more heavily on downloadable software and services with shorter or non-existent lead times.

"The last several years were a good time to get familiar with digitalization," adds Goldsborough. "Enhancing services let us focus more on solution selling and adding value beyond offering products. While in-person training is still preferable for PLCs, variable frequency drives (VFD) and switchgear, we began offering more virtualized training on implementation and troubleshooting, as well as training on NEC and NFPA requirements using digital drawings of equipment and panel schedules. Some users prefer it, while others want hands-on, but the point is they now have options."

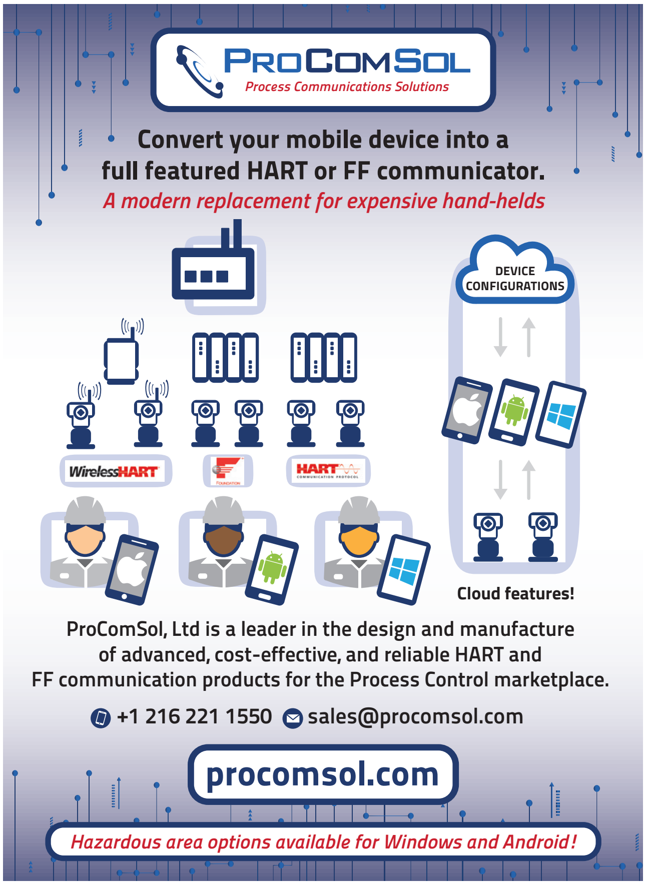
In addition, United Electric launched its Energy & Power Management division within its OnPoint Automation team three years ago, which designs and integrates electrical power monitoring/management systems (EPMS). The group proved its value in 2023, when United Electric was bidding on a switchgear package, which it initially appeared to be losing due to long lead-times issues. The package had internal, "smart" components built into the switchgear, so users could push data to other levels and applications.

"The original quote was for a 12-month lead time, but we were able to separate the smart devices from the switchgear, and quote that hardware separately as standard equipment," explains Goldsborough. "This allowed us to deliver the switchgear hardware in two months, and use United Electric's OnPoint onsite technical team to add the smart items separately and field-install them. We were able to complete the full package in less than three months. This was much faster than the supplier's 12-month lead time for adding the smart components."

Automation defuses disruptions

Just like most strained, inefficient and vulnerable systems, supply chains can also benefit from automation, according to a recent ISA position paper, "Automation drives the global quest for resilient supply chains" (bit.ly/3yn42gd).

"Whether it's COVID-19, the Suez Canal blockage, war in Ukraine or the Baltimore bridge collapse, they can all disrupt supply chains worldwide. Suppliers have been going offshore for decades because of low costs, but this makes their supply chains fragile and brittle," says Steve Mustard, president and CEO of consultant National Automation Inc. (www.linkedin.com/company/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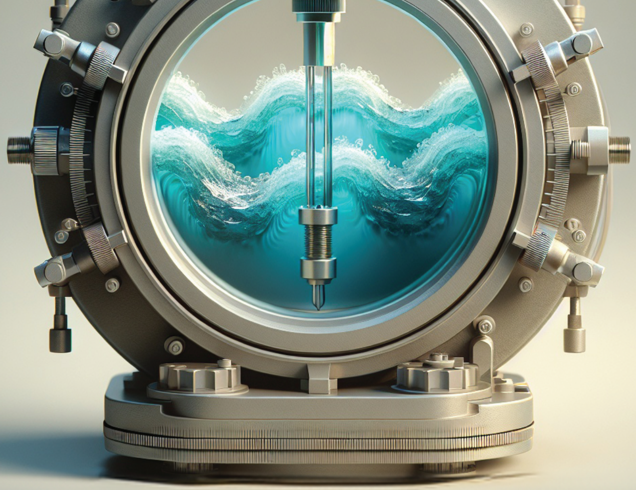
national-automation-inc.) and chair of ISA's content steering committee. "ISA says automation can help strengthen supply chains, and traditional instrumentation, process control, robotics, AI, digital twins and virtualization can all play a part. They can help businesses and their supply chains be more efficient, reduce costs and improve just-in-time manufacturing even if they're onshore."

Chief among these efforts is reshoring microprocessor manufacturing to the U.S. as detailed in the CHIPS Act, which also calls for embracing new technologies and automation to reduce chipmaking costs and increase flexibility. "This would address much of the brittleness in many supply chains. All the suppliers and everyone else that depends on microprocessors would benefit if they were made in more places worldwide, which would allow production to rapidly shift to another region when needed," explains Mustard. "No one wanted to do this before the pandemic, but now they know they've got to be less vulnerable. COVID-19 vaccines were produced incredibly quickly by standing up modular facilities.

"And, because another pandemic or a similar crisis will likely happen in the future, we must recognize and resolve bottlenecks. We can't wait for a contractor to spend six years building a plant. Pharmaceutical companies, chipmakers and other industries must find ways to manufacture quickly by building standardized production modules that are delivered and assembled onsite, and can be relocated as needed. This is similar to the automobile plants that retooled to make airplanes during World War II or NASA's Mercury, Gemini and Apollo programs that met President Kennedy's challenge to put a man on the moon less than 10 years. It's all about will." ∞



Coriolis flowmeters can be ideal for process improvement in challenging installations and process conditions

by Greg McMillan

CORIOLIS KNOWS BEST

THE secret to improving process performance is getting the right mass flows and component concentrations in process streams as seen in your process flow diagrams (PFD). Unfortunately, the most common flow measurements are volumetric. While pressure and temperature compensation can be used to compute a mass flow from volumetric flow, the compensation is based on the stream's assumed composition and physical properties.

There are many installation effects that cause a poor signal-to-noise ratio, and losses in accuracy and rangeability. The most notable is the effect of piping and valves upstream and, to a lesser extent, downstream. Volumetric flow measurements by differential pressure (DP) and vortex flowmeters are also sensitive to velocity profile, viscosity, density, low Reynolds number, bubbles and solids. Also, accuracy is expressed in percentage of span. Because pressure drop is proportional to flow squared, it can make the DP flowmeter signal-to-noise ratio exceptionally poor at low flows. DP flowmeters are also vulnerable to many problems with impulse lines.

Magnetic liquid flowmeter (magmeter) performance isn't sensitive to application conditions that adversely affect other volumetric flowmeters. Magmeter accuracy is a percentage of reading with consequently less deterioration at low flows, and rangeability is five times better than what's stated in publications for DP meters that don't account for significant deterioration in performance due to installation and application conditions. Magmeter performance can be 10 or more times better than a DP meter.

A Coriolis meter is a true mass flowmeter with accuracy and rangeability five times better than a magmeter with an accuracy in percentage of reading that, like a magmeter, isn't affected by installation and most application conditions. Problems with cross talk and pipeline support were solved in the 1990s. Coriolis meters can handle small amounts of bubbles and particles in liquid streams. No maintenance is generally required after initial calibration. Another incentive is extremely accurate density measurement that can be used as inferential measurements of component concentration, notably in raw material feeds, recycling and product streams.

A worthwhile investment

However, Coriolis meters' upfront costs are greater than DP meters, especially for larger lines. Nonetheless, if you consider eliminating maintenance and its extreme accuracy in mass flow and composition control, investing in Coriolis is justified by its reduced lifecycle costs, and improvements in process capacity and efficiency. The fact that Coriolis flowmeters are limited to 14-inch or less line sizes can be addressed by having multiple Coriolis meters in parallel lines.

Process pressure higher than specified for a flowmeter can result in a span error due to increases in flow-tube stiffness. A process temperature different than what was used in the factory calibration of the meter can cause a random error in zero value.

Well-defined online pressure and temperature compensation is possible in these situations.

Coriolis flowmeters are available in high-pressure and high-temperature models with a variety of wetted materials. If a Coriolis meter tube suffers from corrosion and/or erosion, diagnostics have been developed to detect the onset and extent of the problem. Plugging one tube in a dual bent-tube meter reduces accuracy but doesn't disable the meter. The use of a straight-tube instead of a dual bent-tube meter reduces the adverse effects of erosion and plugging. However, straight-tube meters aren't as accurate as dual bent-tube meters.

Pros and cons and considerations

For more on how Coriolis meters can deal with challenging installation and process conditions, see the Control Talk column, "Knowing the best is the best" (www.controlglobal.com/controltalk-flowmeters) and my ISA-published book, *Essentials of Modern Measurements and Final Elements in the Process Industry* (bit.ly/measurement-essentials).

The following excerpts from my McGraw-Hill-published book, *Process/Industrial Instruments and Controls Handbook,* sixth edition (bit.ly/process-industrial), provides additional guidance that's often not detailed in other articles and books.

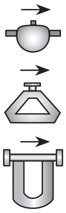
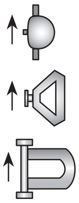
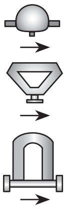
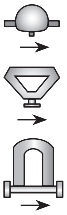
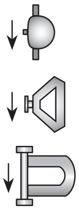
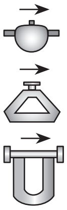
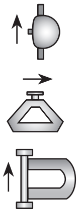
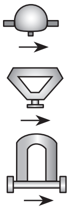
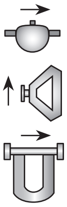
Process	Preferred orientation	Alternate orientations	
Liquids			
Gases			
Slurries			

Table 1: Coriolis installation orientation per fluid type

BEST PRACTICES FOR SELECTING A CORIOLIS METER

1. Select Coriolis sensor material that's chemically compatible with all expected process fluids and cleaning/flushing agents.
2. Orient the meter to keep it full and avoid two-phase conditions. For liquids, this is tubes down or flag position flowing up. For gases, it's tubes up or flag position flowing down.
3. Size the meter properly to maintain the best measurement performance across the full process flow range within acceptable pressure loss range.
4. Insulate and/or heat-trace the meter for best density, concentration and volume measurement performance, or if temperature changes will cause undesirable effects such as flashing, condensation or freezing.
5. Verify that calibration constants from the sensor are reflected properly in the electronics.
6. Locate all control valves downstream of the meter to provide backpressure (and keep the tubes full).
7. Perform a zero calibration if the normal process temperatures or pressure are far from the manufacturer's calibration conditions. Circulate fluid at process pressure until all meter components are brought to thermal equilibrium, then block the meter in with no flow, and zero the meter.
8. Determine a field baseline for tube-integrity diagnostic test values (aka meter verification) if required by the manufacturer.

Dual bent-tube sensor benefits include:

- Excellent accuracy, repeatability and measurement range for flow and density;
- Excellent mechanical system balance and strong signal-to-noise ratio;
- Excellent immunity to field effects, such as plant and pipe vibration; and
- Minimal (or no) thermal stresses or mounting effects.

For these reasons, this style is often preferred for custody transfer, gas flow and variable flow regimes, including two-phase flow such as entrained gas in liquid or entrained liquid in gas (mist).

Dual bent-tube sensor disadvantages include:

- The flow splitting manifold and long tube length contributes to additional pressure losses;
- If one tube becomes plugged, it's difficult to clear or mitigate blockages without mechanical intervention; and
- The bent-tube body requires more clearance around the pipeline.

Single, straight-tube design: Straight-tube sensors are often constructed from premium materials (such as titanium), which provide low thermal expansion in a constrained space and flexibility to maximize resolution from limited tube movement. Straight-tube sensors constructed of other materials, such as stainless-steel, are more susceptible to thermal stresses, which can affect flow and density accuracy in process conditions that differ from calibration process conditions.

Orientation

Additional installation considerations:

- Coriolis sensors are considered bidirectional.
- For liquids and slurries, flowing upward is recommended.
- For gases, bent tubes up or flowing downward is recommended.
- Control valves should be placed downstream of the meter, and as close as possible to the meter to avoid unnecessary holdup volumes.
- Don't use the meter to align pipework, and minimal torsional stress should be applied.

- No external supports are needed for the sensor body. The flanges will support the sensor in any orientation. Some small sensors are available with mounting brackets to simplify installations using flexible tubing or wall-mounting.

Flow conditioning

No upstream/downstream flow conditioning is required. However, if two-phase flow exists occasionally, best performance will be achieved by ensuring that the fluid is homogenously mixed and divided equally into both sensor tubes. In this case, it's recommended that a blind T or static mixer be placed upstream of the meter.

Calibration and maintenance:

Coriolis meters are extremely linear compared to most other flow technologies. Each Coriolis meter has one unique set of calibration constants that apply equally across the entire measuring range of the meter, including a mass flow calibration factor (FCF), density calibration factors, and temperature and pressure constants. It's generally not necessary to specify that custom flow rates or custom fluids be used during calibration or to linearize the calibration.

In general, anything that causes a change in stiffness of the sensor tubes will affect the vibration qualities of the sensor. Erosion and corrosion can be mitigated by sizing the sensor properly and by selecting compatible materials, but process temperature and pressure also affect tube stiffness.

Most Coriolis manufacturers include a resistive thermal device (RTD) inside the sensor to measure the temperature of the tubes, and apply a temperature compensation factor to correct for the change in tube movement due to temperature. Expect to find unique thermal expansion coefficients for flow (FT) and/or density (DT) published by the manufacturer. Also, expect to find unique pressure effect coefficients published by the manufacturer to account for expected offsets in the measured flow and density values at high pressures. This is primarily a concern for larger sensor sizes with larger internal surface areas to contain fluid pressure.

Coriolis sensors typically don't include any user-serviceable parts, other than electronics. For critical applications, maintain a complete spare flowmeter in the event of a suspected component failure or perceived measurement offset. To discriminate between perceived issues and true equipment failures, Coriolis manufacturers offer in-situ diagnostic capabilities to help verify meter functionality in the field.

Drive gain is a useful diagnostic variable. It indicates the amount of electrical current the drive coil is using to maintain the sensor vibration at its harmonic frequency. Typical drive gain values for clean fluids are typically low (<10%), but any value under 100% means the sensor has achieved the desired vibration profile using available energy. However, if the drive gain reaches 100%, this indicates the sensor is out of balance, and the drive coil is unable to control the sensor's vibration using even the maximum available current. A 100% indication is typical when corrosion, erosion or coating has developed, when one of the tubes is plugged, or when large changes occur in the process. These changes include valves opening or closing swiftly (brief spikes) or tubes that aren't full (i.e. slugs or gas bubbles). They also include rapid changes in the fluid's properties, such as interface between two fluids of differing densities.

Known density

This is a technique that can be used in the field to verify density performance and structural integrity of Coriolis sensors within a reasonable expectation of error. The theory holds that, if you fill a sensor with a known-density fluid under controlled conditions and the sensor accurately measures the fluid density and the sensor is in otherwise good condition (i.e. no physical changes or damage has occurred), then the sensor is likely capable of making good flow and density measurements. Any change to the sensor's vibration qualities is indicated in the measured density, which is more sensitive to errors from structural changes than flow.

Sensor tube integrity is a newer Coriolis diagnostic technique (often called meter verification) that drives the sensor tubes at a series of test frequencies, and compares the response to a set of reference values determined when the sensor was in a known and good condition. Because the meter's electronics are required to drive the test tones and interpret the sensor response, this also verifies that the electronics are working properly. ∞

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Past Chairman
Emerson Automation Solutions

NEVER let a bit of uncertainty stand in your way. That's the message John Berra wants new and existing business leaders to take away from his new book, *Turning the Giant, Disrupting Your Industry with Persistent Innovation* (Forbes Books, March 2024, turningthegiant.com). Past chairman of Emerson Process Management (now Emerson Automation Solutions) and a *Control* Process Automation Hall of Fame inductee in 2011, Berra writes that "giants," such as technological advances and increasing global competition, make the challenges that process control industry leaders face more complex than ever. It's hardly the time to get caught up in one's own uncertainties because—though they may look different through time—those giants will always exist and need to be slain. So, it's better to use them to your advantage.

Turning the Giant shows today's business leaders how to do it.

Berra is an ideal messenger in this case because his 40-plus-year career in process control gave him expertise and insights that helped individuals and organizations achieve their full potential. Before leading Emerson Process Management, he served as president of Fisher-Rosemount Systems, and was the process group business leader for Emerson Electric. In addition to the Process Automation Hall of Fame, he was named one of the 50 most influential industry innovators by *Intech* magazine. He also served on the boards of Ryder System and National Instruments.

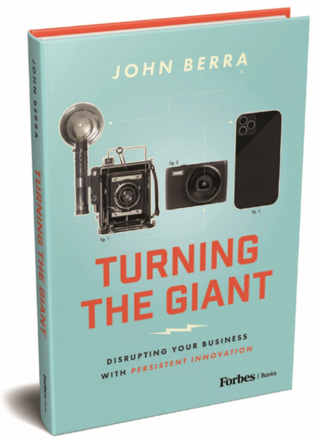
Berra shows how leaders can deal with their own self-doubt and skepticism, while simultaneously seizing on solutions to ever-growing challenges such as corporate bureaucracy, rapid innovation, intense competition and, ultimately, maintaining success. Each chapter in the book is devoted to lessons on facing these challenges and turning them to your advantage.

Berra guides readers to identify the strategic value of each obstacle. He tackles the frequent business disruptions that are usually out of leaders' control, but require attention to stay ahead of the competition. One example of his experience was the introduction of Delta V from Emerson, which was ahead of its time in the mid-1990s.

Technically speaking, *Turning the Giant* is a business and finance book. However, its readers may feel like they're perusing the self-help section of their local bookstore. At its core, the book inspires positive thinking and self-reflection from those in the business world who may need it most, but don't always have the time or best skills to step back to ponder their own vulnerabilities. It's this aspect that makes this book different from a traditional how-to for the business world.

Berra doesn't come across like a new-age guru, though. Like any good business leader, he maintains a practical approach to problem solving. *Turning the Giant* has no shortage of insights, and includes quotes from world and business leaders as varied as Winston Churchill and Elon Musk. However, Berra maintains a straightforward approach drawn from his own experience in business. He isn't shy about sharing personal stories from his career and acknowledging his standards and expectations for himself.

If you're looking for a strategy to help maneuver business and personal challenges, *Turning the Giant* is well worth your time. ∞



Enterprise asset integration grab bag

Control's monthly resources guide

NINE USERS MANAGE ASSETS

This online article, "How real users benefitted from effective asset management (AM)," demonstrates how nine end-users put AM principles into practice, and improved performance over the lifecycles of their processes and facilities. Thes users include DuPont, Lonza, Synthomer, Petrobras, Appleton, Eli Lilly, We Energy, Cheron and TPC Group. It's at www.emerson.com/documents/automation/brochure-how-real-users-benefited-from-effective-asset-management-ams-en-4194006.pdf

EMERSON
www.emerson.com

PIPELINE CORROSION BASICS

This 65-minute webinar, "Pipeline corrosion and integrity management" by Stephen Ciaraldi, covers corrosion basics, hazard and risk assessment, asset registry, incident causes, hazard barriers, inspection strategies, chemical treatments, surveying and testing, cathodic reactions and other topics. It's at www.youtube.com/watch?v=BpmpU1wDxe4

ESANDA ENGINEERING
www.esandaengineering.com

DATA FOR DIGITAL TWINS

This eight-page whitepaper, "Embracing digital twin technology for engineering assets" by Steve Parvin of Aveva, covers the benefits of digital twins for industrial teams, and shows how engineering data provides the structure to create digital twins and provide 3D visualization. It's at discover.aveva.com/paid-search-design-and-build/whitepaper-embracing-digital-twin-technology-engineering-assets

AVEVA
www.aveva.com

INTEGRITY AND AI

These two 45-minute webinars, "Asset integrity management (AIM) implementation" and "Leverage AI to improve uptime and reduce costs in process automation," are presented by TÜV Rheinland and Metegrity. The first video covers the pros and cons of implementing AIM in onshore and offshore facilities. The second video shows how to develop a digital transformation roadmap, and combine it with a reliability centered maintenance (RCM) program. They're at www.youtube.com/watch?v=lOYC5yRUlvE and at www.youtube.com/watch?v=Y8pcaqi2Lko

RISKTEC
risktec.tuv.com

EPA SLIDES ON AM TOPICS

This 39-slide deck, "Fundamentals of asset management (AM)—Step 7, optimize operations and maintenance (O&M) investment," covers key performance indicators (KPI) from an AM perspective, compares CMMS and enterprise asset management software (EAMS), and seven questions about reliability-centered maintenance, and using failure modes to determine maintenance strategies. It's at www.epa.gov/sites/default/files/2016-01/documents/epa-7-o-m.pdf

U.S. ENVIRONMENTAL PROTECTION AGENCY
www.epa.gov

INTRO TO ISO 55000

This 65-minute video, "Asset management: an introduction" by David Albrice, covers the definitions, reasons and procedures for performing AM and integrating the ISO 55000 international AM standard. management of assets. It also presents information on AM software, processes, and financial and risk analysis. It's at www.youtube.com/watch?v=JUmdVYQ-0Aw

ASSET INSIGHTS AND ENERPEC
assetinsights.net and enerpecc.com

EAM FOR SOLAR PROJECTS

This online article, "Enterprise asset management (EAM) seamless integration," shows how SOLV, a California-based operations and maintenance provider, used a searchable, traceable EAM platform to streamline its utility-scale solar power projects. It's at www.dematic.com/en-us/insights/case-studies/swinerton-renewable-energy

DEMATIC
www.dematic.com

STATE-BASED CONTROL

This online article, "Consider state-based control," reports that users often overlook automation systems as a way to improve overall equipment effectiveness (OEE), and recommends using different states/phases of process applications and associated software faceplates to adjust and optimize operations. It's at www.chemicalprocessing.com/home/article/11373396/oee-consider-state-based-control-chemical-processing

CHEMICAL PROCESSING
www.chemicalprocessing.com

ERP + MES = LEAN

This online article, "Industry 4.0: harnessing the power of ERP and MES integration" by Yuval Lavi, VP at Magic Software, covers six ways integrating enterprise resource planning (ERP) software and manufacturing execution system (MES) software can make production leaner.

INDUSTRY WEEK
www.industryweek.com

The effect of global warming on precipitation

Global warming reduces precipitation in the sub-tropic regions

This column is moderated by Béla Lipták, who also edits the *Instrument and Automation Engineers' Handbook, 5th edition*, and authored the recently published textbook, *Controlling the Future*, which focuses on controlling of AI and climate processes. If you have a question about measurement, control, optimization or automation, please send it to *liptakbela@aol.com*. When you send a question, please include your full name, job title and company or organization affiliation.

Q: I read with interest *Control*'s review of your latest book (www.controlglobal.com/human-footprint). There's a statement in Len Vermillion's review that, without change there will be a "rise of more than 2.5 °C, making the tropics unlivable." This effect on the tropics is new to me, and I'd like to learn more about it.

DAVE STROBHAR, PE
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A1: Global warming increases total precipitation on the planet because, as land and ocean temperatures rise, the rate of evaporation increases, which in turn increases the moisture content of the atmosphere. The increased rate of evaporation must be matched by an increased rate of condensation (precipitation) to keep the global rate of water circulation constant. Therefore, dry regions of the planet get even more arid due to increased evaporation, while wet regions get wetter due to increased precipitation. In addition, rising global temperatures shift the climatic zones around the planet.

The tropics are located between the Tropic of Cancer and the Tropic of Capricorn, at about 23° north and south. Global warming causes an increase in evaporation near the equator as humid, hot air rises and moves towards the poles. While moving, it cools and its moisture content condenses, causing precipitation in the tropics. By the time this current of air falls back to the earth, somewhere at around 30° latitude north (the top of the Sahara Desert and Mexico) and 30° south (the bottom of the Kalahari Desert), it is very dry.

Global warming causes the dry edges of the tropics to expand as the subtropics push north and south, bringing more dry weather to places like the Mediterranean Sea. These subtropical regions are the ones that dry up as global warming makes them unlivable due to food and water scarcity, which causes a collapse of local economies and public health (Figure 1).

The edges of the tropics are moving at a rate of about 0.2 - 0.3° latitude per decade (to the north and the south). A desert's edges are defined as the lines inside which rainfall is less than 4 inches per year. According to some studies, the dry southern edge of the Sahara moved nearly 81 miles south in the 10 years between 1980 and 1990.

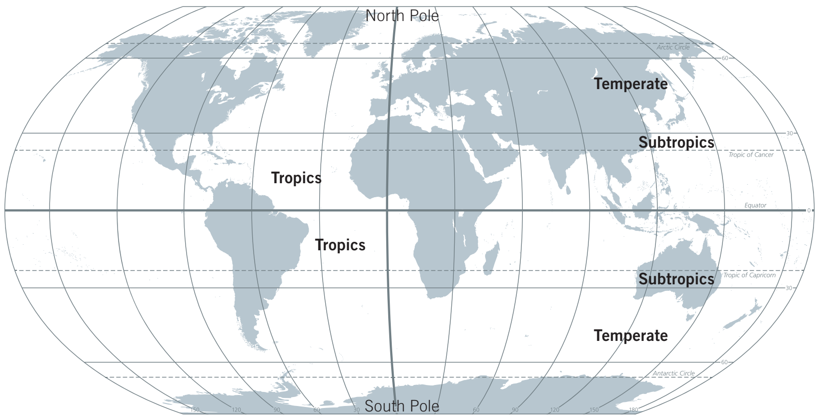
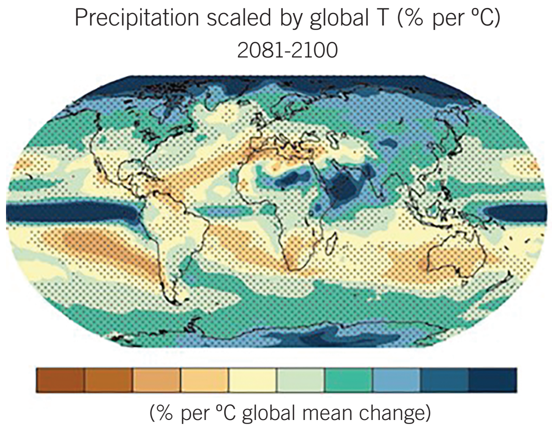


Figure 1: Global warming reduces precipitation in the subtropical regions, expanding the Sahara Desert.



Precipitation scaled by global T (% per °C)
2081-2100

Figure 2: Color-coded zones show percent changes in precipitation expected due to a 1 °C global temperature increase. Zones with projected 6 - 12% increases in precipitation are increasingly dark blue, and zones with projected 3 - 12% decreases in precipitation are yellow to brown.

In specific locations, precipitation is affected by many variables other than global temperature. The color-coded zones in Figure 2 show the percent change in precipitation likely to occur due to a 1 °C global temperature increase.

BÉLA LIPTÁK
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Q: How much distance should be maintained from the orifice center hole to a drain (or vent) hole?

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A1: Vent holes are as close to the edge of the pipe as possible because their purpose is to remove gas or liquid that otherwise changes the apparent pipe diameter if allowed to accumulate. The vent hole for liquid flow is at the top of the pipe to vent trapped gas. Similarly, the drain hole is at the bottom for gas flow to drain trapped liquid.

BILL HAWKINS
instrument engineer
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A2: The purpose of a drain (or vent) hole is to allow liquids (or gases) to pass through the orifice plate without building up on the front side. Consider a saturated steam line. If condensate begins to form in the bottom of the pipe, it carries down the pipe until it encounters the orifice plate where it will be trapped. The water continues to build in front of the plate until it gets high enough to pass through orifice bore and continue down the line. The liquid level in front of the pipe changes the flow profile and increases the fluid velocity, greatly impacting the orifice reading.

If the orifice plate has a drain hole located near the wall of the pipe, and the drain hole is mounted on the bottom, the water will pass through the hole and there will be minimal buildup in front of the orifice. The same is true for a vent hole in a liquid line. In this case, the vent is located at the top, near the pipe wall, and lets vapor travel down line and through the orifice without building up in front.

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A3: The location of the orifice drain/weep hole should be as close as possible to the nominal pipe-size diameter, which is 90% to 98% of the nominal size. The bottom drain hole is located below the orifice and diametrically opposed to the handle. The top weep hole is located above the orifice and directly beneath the handle. The size of these drain/weep holes should be less than 10% of the total flow, so they'll affect the total flow by less than approximately 1%.

The distance between these holes and the actual orifice depends on the following: in a concentric orifice plate, the orifice opening is in the center of the plate with a β ratio between 0.25 and 0.75. The drain/weep holes are located between 90% and 98% of the pipe diameter, and have a diameter of their own of 10% of the orifice.

So, if we have a 6-inch ANSI Schedule 40 pipe, where the inside nominal diameter is 6.065 inches and outside diameter is 6.625 inches, and if we have chosen a β ratio of 0.5, then the orifice diameter is 6.065 inches x 0.5%, which means the orifice is 3.03 inches in diameter and centered 4.55 inches from the inside edge of the pipe. This ratio is assumed as a result of previously run flow calculations.

If the size of the drain/weep hole is maintained as 10% of the β ratio, then the drain/weep hole is 0.30 inches and located approximately at 95% of the inside diameter of the pipe or 6.065 inches x 95%. This would mean the drain/weep hole is centered at 5.76175 inches. And, since we calculated it at 0.30 inches, the opening would be 5.61 inches from the center and 5.91 inches from the pipe edge. Therefore, the distance of the drain/weep from the orifice is 1.06 inches.

If you need a drain/weep hole, the next important task is to determine the size of the particles to be passed and how their dimensions affect the overall flow measurement by impacting the β ratio. Finally, the actual dimensioning of drain/weep holes should be maintained, so they don't affect flow calculations.

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Gateways bridge to bring home data

Switches establish links to once-isolated devices, so they can put what they know in front of users

IIOT-ENABLED, WIRELESSHART GATEWAY

FieldGate SWG50 WirelessHART gateway is compact, and readily integrates with Endress+Hauser's Netilion cloud-based, IIoT ecosystem. SWG50 can be paired with Endress+Hauser's FieldPort SWA70 and SWA50 adapters. It also features network migration by changing the network ID and joining keys, color-coded device list, four RJ-45 connectors, redundant power supply, Modbus TCP and HART-IP outputs, and IP20 housing with DIN-rail mounting and 100 node connections.

ENDRESS+HAUSER
eh.digital/3NUGdA6

GIGABIT SWITCH WITH 10 PORTS

LNX-1202G-SFP gigabit, unmanaged Ethernet switch from Antaira Technologies features 10 x 10/100/1000 Tx ports and two dual-rate 100/1000 SFP slots. It supports a 24 Gbps backplane, 8 K MAC address table, and 9.6 Kbytes jumbo frame. LNX-1202G-SFP has a redundant power input (12~48 VDC) and built-in relay output for power-failure warnings. It also provides high EFT and ESD protection, while its metal case supports wide operating temperatures.

GALCO
www.galco.com

MULTI-PROTOCOL CONVERSION SUPPORT

SoftPLC gateways can be user-configured to support a mix of Ethernet and serial protocols, such as Ethernet/IP, ModbusTCP, Modbus and DF1. They support multiple channels of Allen-Bradley Remote I/O (RIO) or Data Highway Plus (DH+), bridge devices from multiple vendors, and let Rockwell PLC/PAC users easily upgrade otherwise obsolete drives, robots, HMIs and other devices without requiring PLC replacement or changes or adding costly communication modules to a Logix PAC.

SOFTPLC
800-SoftPLC (763-8752) or 512-264-8390; www.softplc.com

GATEWAYS USE RS-232/422/485 INTERFACE

DeviceMaster serial gateways integrate participating devices with an RS-232/422/485 serial interface to higher-level Ethernet networks and protocols, such as EtherNet/IP, Modbus TCP and Profinet. They come with security mechanisms, including a secure socket layer (SSL) key, secure shell (SSH) management and SSL serial data stream encryption. They're available with connection options for DIN rail, panel and rack mounting.

PEPPERL+FUCHS
www.pepperl-fuchs.com

MODBUS TCP TO ETHERNET AND PROFIBUS

Anybus Communicator Modbus TCP-client gateways connect Modbus TCP devices to EtherCAT, EtherNet/IP, Profibus and Profinet protocols. They also feature high-speed communication with data transfers up to 1,500 bytes; reliability verified by compliance with CE and UL standards; cybersecurity thanks to an onboard physical security switch and secure boot functionality; forward-facing ports and DIN-rail mounting; and user-friendly configuration with an intuitive, web-based GUI.

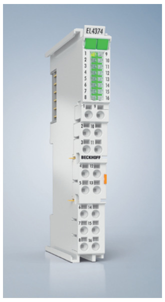
HMS NETWORKS
312-829-0601; www.hms-networks.com/network-gateways

ZERO-TRUST REMOTE ACCESS

SiQ-R WinCPU R102WCPU-W or RD55UP12-V C modules are enhanced by Dispel's Zero-Trust Remote Access platform, and comply with NIST/IEC 62443 standards. Dispel establishes visibility and control over industrial systems and user access via a centralized cybersecurity dashboard. Dispel protects against cyber-threats with its Moving Target Defense that continuously reconfigures and encrypts data pathways.

MITSUBISHI ELECTRIC AUTOMATION INC.
us.mitsubishielectric.com/fa/en/products/digital-solutions-software/dispel

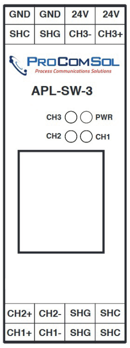
ANALOG I/O FLEXIBILITY WITH ETHERCAT



EL4374 EtherCAT terminal serves as a multipurpose, combined input/output for -1% to +10 V or -2%/+4 to +20 mA signals that can be used for automation tasks at 1 kbps per channel. EL4374 combines two analog inputs and two analog outputs in a compact 12-mm housing. Users can individually parameterize these channels for current or voltage mode using Beckhoff's TwinCAT 3 automation software. The analog inputs and outputs are digitized with a resolution of 16 bits.

BECKHOFF
www.beckhoff.com/el4374

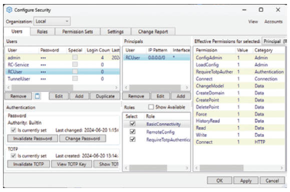
SWITCH ALLOWS ETHERNET-APL LINKS



Ethernet-APL 3 Channel Switch (APL-SW-3) lets transmitter suppliers incorporate Ethernet Advanced Physical Layer (APL) into their devices. APL-SW-3 has a power supply connection, three Ethernet-APL channels and an RJ-45 Ethernet connector. It uses a 24 VDC power supply. The host system uses HART-IP to configure and monitor APL transmitters connected to the switch. Any HART-IP compliant host, such as ProComSol's DevCom apps, can access the APL transmitter.

PROCOMSOL LTD.
216-221-1550; www.procomsol.com

NETWORKING SOFTWARE ADDS SECURITY



Organization: Local

Users

User	Password	Special	Login Coun	Last
admin	•••	☐	4	202
RC-Service	•••	☐	0	
RCUser	•••	☐	0	
TunnelUser	•••	☐	0	

Principals

User	IP Pattern	Interface
RCUser	0.0.0.0/0	*

Effective Permissions for selected: Principal (

Permission	Value	Category
ConfigAdmin	1	Admin
LoadConfig	1	Admin
RequireTotpAuther	1	Authentication
Connect	1	Connection
ChangeModel	1	Data
CreateDomain	1	Data
CreatePoint	1	Data
DeletePoint	1	Data
Force	1	Data
HistoryRead	1	Data
Read	1	Data
Write	1	Data
Connect	1	HTTP

Authentication
Password
Authority: BuiltIn
☑ Is currently set Last changed: 2024-06-20 1:15
TOTP
☑ Is currently set Last created: 2024-06-20 13:14:

Roles ☐ Show Available

Select	Role
☑	BasicConnectivity
☑	RemoteConfig
☑	RequireTotpAuthentic

Cogent DataHub, Version 11, has integrated a security model for real-time access to process data. By supporting lightweight directory access protocol (LDAP) and time-based one-time password (TOTP)—and adding a data diode mode—this networking software makes secure, outbound connections through firewalls. Cogent DataHub lets users configure security accounts from a local Windows software device or external LDAP server, as well as authenticate using TOTP.

SKKYNET
www.skkynet.com

EIGHT PORTS WITH 10/100 MBPS

multicomp PRO
MP-508

Multicomp Pro MP-508 Ethernet switch provides 10/100 Mbps communications via eight ports. It also has dual, redundant power inputs ranging from 5 VDC to 30 VDC. Its compact design with DIN mount saves space, while plug-and-play functions enable easy setup with no software required. Broadcast-storm protection maintains network stability and reliability. MP-508 is also DIN-rail mountable and RoHS compliant.

NEWARK
www.newark.com/multicomp-pro/mp-508/unmanaged-ethernet-sw-8port-din/dp/39AH5509

16-PORT, UNMANAGED ETHERNET SWITCH

N-TRON SERIES

N-Tron NT116 unmanaged, industrial Ethernet switch supports data acquisition, Ethernet I/O and process control. It includes 16 high-performance, copper ports (10/100BaseTX RJ45) with built-in ESD and surge protection. NT116 is housed in a rugged, metal enclosure, and tolerates high shock and vibration, while users benefit from a 1.2 M-hour MTBF rating. It's also compact with a slim, space-saving design that operates at -40 °C to 85 °C.

RED LION
www.redlion.net/NT116

WIRELESS, LORAWAN SENSORS

EVA-2000 wireless sensors use long-range, wide area networking (LoRaWAN), and are seamlessly compatible with Advantech's Wise-6610, LoRaWAN gateway. EVA-2000 has low power consumption from two 3.6 V Li-ion batteries. Each unit has an embedded antenna in a compact design. The series includes EVA-2210 three-phase current meter, EVA-2310 temperature and humidity sensor, EVA-2311 with PT1000 heat-probe sensor, and EVA-2510 water-leak sensor.

ADVANTECH
www.advantech.com

Simulation and innovation for best process control

How first-principle simulations enable process control improvements

GREG MCMILLAN

Gregory K. McMillan captures the wisdom of talented leaders in process control, and adds his perspective based on more than 50 years of experience, cartoons by Ted Williams, and (web-only) Top 10 lists. Find more of Greg's conceptual and principle-based knowledge in his Control Talk blog. Greg welcomes comments and column suggestions at ControlTalk@endeavorb2b.com

GREG: Much of the success in my career stems from developing conceptual knowledge to improve process control. I always sought to understand fundamental principles and cause-and-effect relationships for a bigger picture that allowed me to extend beyond a particular application to a spectrum of applications.

To provide detailed guidance on this process and how to sustain best process control performance, we asked Edin Rakovic, president of customer success, and Spencer Absher, president of business development, both at Prosera (https://prosera.com), an industrial software advisory firm.

EDIN: Initially, understanding how simulation enhances plant performance beyond control testing, while qualifying operators, can be challenging. To begin effectively, a discovery process is crucial to consider various use cases and develop a vision with KPIs for the plant. The outcome is a comprehensive success plan that drives organization-wide engagement and effective adoption of the new simulation solution.

SPENCER: Simulation fidelity isn’t used as the sole criterion to determine the right simulation solution path. Instead, one must consider input from multiple teams to expand the simulation's use case across the plant. The simulation solution is the foundation on which we can build the best process control performance and operator performance.

GREG: What is the value of extending use beyond operator training?

EDIN: While traditionally focused on operator training, simulation solutions are critical as industries face up to 40% workforce turnover due to retirements. Expanding simulation technologies beyond training enhances plant performance.

SPENCER: Using a multi-purpose dynamic simulator (MPDS) adds value by reducing engineering efforts, enabling design validation, supporting virtual commissioning and startup, ensuring operator readiness, and facilitating optimization studies. We leverage modern simulation platforms to explore proven use cases, and partner with our clients to enable innovation within industrial software.

GREG: How can simulation tools be integrated into daily plant operations?

EDIN: It involves using simulation systems for ongoing training and real-time operational support. This approach ensures that operators refine their skills, and apply learned strategies directly to actual plant scenarios.

SPENCER: Software must be accessible and easy to use, which is achieved by selecting the correct platform/technology and guided training programs. Enhanced decision-making and response times across the plant are possible by embedding simulation tools into daily operational practices.

GREG: What’s the role of finding and justifying the best instrumentation and control systems?

EDIN: With advances in simulation, the best instrumentation and control systems can be selected early in the design process through digital twins and integrated models, which provide recommendations for optimal plant performance based on simulated data.

SPENCER: Increasing the value of the simulation model allows us to go beyond traditional practices when selecting the best instrumentation and control systems. Instead, we use inputs from digital twins to guide these decisions without the presence of physical instrumentation and other control system assets.

GREG: How do you choose purpose and fidelity?

EDIN: Designing a digital twin involves considering numerous factors, notably the purpose and model fidelity. Purpose is usually established early through discussions about use cases and direct operational impacts. Model fidelity, reflecting the realistic behavior of each process unit, should be flexible to ensure quick initial business outcomes and maximize long-term return on investment (ROI).

SPENCER: Deploying high-fidelity models for the entire simulation is seldom the correct approach. This uniform approach is flawed and misses a deeper use-case understanding of the solution. We deploy flexible fidelity solutions tailored to each specific purpose.

GREG: How do you justify investment in development and maintenance?

EDIN: Contrary to misconceptions, investing in digital twins is more justifiable due to technological simplifications. Solutions incorporating multiple fidelity levels let end-users maximize ROI by developing models of appropriate complexity to achieve desired outcomes. Costs are distributed across teams, enhancing operational efficiency, reducing process downtime, and aiding decision-making.

SPENCER: The right simulation solution must align directly with the ROI; simulation is more accessible than ever. We support our clients by fully implementing multiple digital twins to maximize benefits across their facility. We develop technology to reduce the human capital invested in developing and maintaining digital twins.

GREG: How do you get operators, process, automation, mechanical engineers and technicians to develop and continually use dynamic simulations?

EDIN: Successful technology adoption hinges on early and relevant engagement with all stakeholders, aligning challenges with digital-twin use-cases, and providing thorough training to simplify technology use.

SPENCER: Early and comprehensive engagement is critical for teams to develop solutions that address individual needs. By engaging with industry experts in the early stages of technology selection, we ensure that new technology is relevant, applicable and user-friendly for all teams.

GREG: How do you sustain and continually increase the benefits of improving process safety, efficiency and capacity?

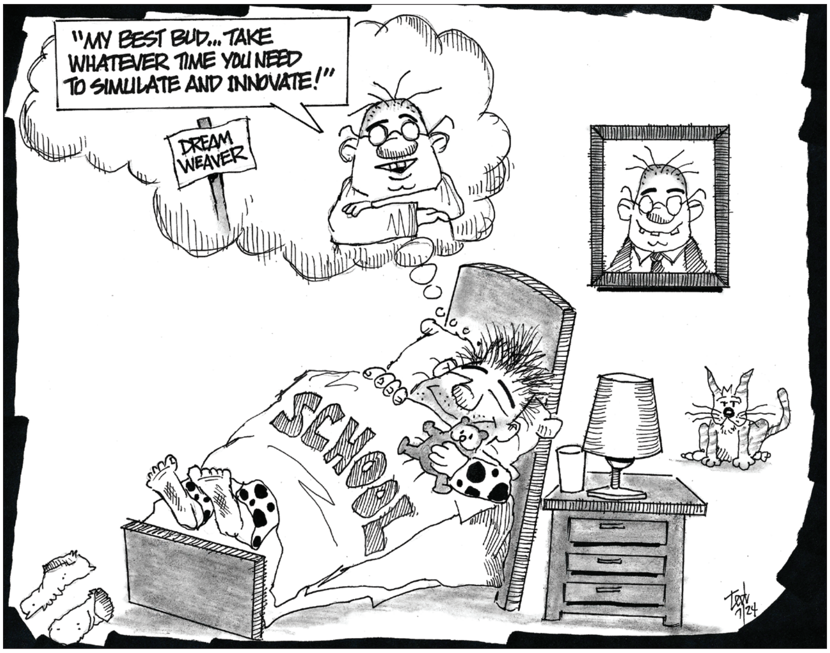
EDIN: Effective, plant-lifecycle management involves setting up a multi-year success plan with clear KPIs, maintaining the simulation platform and models, and establishing clear ownership and feedback mechanisms in the organization.

SPENCER: The benefits of digital twins increase by having a program for maintenance and continual improvement of implemented solutions. This is achieved by implementing technology for digital-twin maintenance or increasing equipment fidelity to unlock increased value.

GREG: What are the benefits of using high-fidelity simulations in operator training?

EDIN: High-fidelity simulations provide detailed and realistic scenarios that closely mimic actual plant operations, improving training quality by exposing operators to near-real conditions without the associated risks. This level of detail enhances skill development, particularly for handling complex and hazardous situations.

SPENCER: There's a level of detail required of the model to achieve true knowledge transfer. A key area where we don't want to compromise is the quality of simulation in areas critical to safety and operational efficiency. ∞


"MY BEST BUD...TAKE WHATEVER TIME YOU NEED TO SIMULATE AND INNOVATE!"
DREAM WEAVER
SCHOOL

To read an extended version of this column and to see the Top 10 reasons a career change may be necessary, visit www.controlglobal.com

You do it

Be aware of the real prices of products and supply-chain infrastructures

JIM MONTAGUE
Executive Editor
jmontague@endeavorb2b.com

> **“Everyone loves a great deal, but it’s not hard to perceive the thread of inertia and laziness running through the dirty jobs we love to avoid.”**

WE’RE all well-aware of the shortages and seemingly endless lead-times that occurred during the COVID-19 pandemic, and continue to persist among microprocessors and other items. However, when covering this issue’s “Ties that bind” cover story (p. 22), I kept running into questions about how our supply chains got to be so strung-out and vulnerable.

Naturally, the relentless search for the cheapest possible labor and materials created most of today’s worldwide supply chains. In recent decades, it filled today’s ridiculously overstuffed container ships, so they could deliver my coffee cup, laptop PC, box fan, toothbrush, clothes, shoes and practically every other product we use or consume. I haven’t checked labels lately, but I’m sure everything still comes from China or relatively close by.

It's beyond old news that almost all video recorders were invented and produced in the U.S. However, the inexorable lure of inexpensive, unregulated, non-union labor quickly shifted almost all VCR manufacturing to Japan, Korea and elsewhere decades ago.

Likewise, I believe the largest deposits of rare earth ores are still in North America and Australia. However, we also got tired of doing that job, so China processes most of the rare earths used in everything from smart phones to electric vehicles. Hopefully, someone’s looking at reopening our rare earth mines.

Even China recently got weary of processing our recyclable plastics, so all our waste is once again glutting storage facilities, not being recycled, and threatening to fill landfills.

I’m far from saying I’m immune, of course. I was as grateful as anyone when I found a refracting telescope for $10 at my local drugstore years ago. It amazingly allowed my daughters and I to see Saturn’s rings, and I didn’t ask any deeper questions at the time.

Everyone loves a great deal, but it’s not hard to perceive the thread of inertia and laziness running through the dirty jobs we love to avoid. I also haven’t checked on who’s mowing all the lawns in the U.S., but it’s pretty obvious in my suburban Chicago neighborhood and likely in many others.

No less than the PLC’s late inventor, Dick Morley, once reminded me that, “A professional who mows his own lawn has the most expensive service in town.” It was hard to argue hourly rates of business, engineering or technical personnel compared to minimum-wage lawn guys or day-laborers.

However, I also realized that Morley’s estimate didn’t include several key aspects that can make mowing my law or any do-it-yourself task a better deal. First, I save the pittance it would cost to have someone else do it. Second, I get a free and much-needed aerobic workout that could cost plenty at a health club, as well as postponing the sky-high costs of a cardiac event awhile longer. Third, I build a little character, accrue some humility, and reconfirm the get-up-and-go that I’ll no doubt need to be reminded of soon.

I believe there are many less obvious expenses and advantages that aren’t reflected in superficial price tags for products with longer and riskier supply chains. Cheap labor and materials may be too powerful to ignore in the short-term, until we start to add up the benefits of long-term quality, stability, consistency and not having to wait a couple of years for microprocessors or parts that can delay or kill products, projects and entire companies.

I consider myself a fan of capitalism because I rolled around in the first four $20 bills I ever earned. However, I also learned that money is just a tool and symbol that’s mutually agreed to by the participants in any economy. This is why it’s crucial to look behind prices, and evaluate the true costs of supply-chain infrastructures and other long-term factors. The good news is many positive changes are possible if we reexamine and redirect the dollars we vote with every day. ∞

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